

GTIPA Perspectives: COVID-19 Impacts on Adoption of Artificial Intelligence



GLOBAL TRADE & INNOVATION
POLICY ALLIANCE



Table of Contents

Introduction.....	6
What is Artificial Intelligence?	6
COVID-19, Innovation, and AI	7
Summary and Highlights of GTIPA Contributions	7
Argentina	10
I. Gala: Galicia Bank’s Virtual Assistant	10
II. EntelAI Pic COVID-19.....	10
III. Prometea.....	11
Australia.....	13
I. Slowdown in Machine-learning Adoption.....	13
II. The Australian AI Action Plan and Other Government Initiatives.....	13
III. University of Sydney and DetectED-X Improved COVID-19 Diagnosis Using AI.....	14
IV. The Role of AI in Australia’s Economic Recovery From COVID-19.....	14
Austria	15
I. Austria’s Artificial Intelligence Mission	15
II. Focus on the Health Sector: AI Against COVID-19	15
III. COVID-19 as a Catalyst for Research	17
Bangladesh.....	18
I. The Government’s Incubation of Local AI Development	18
II. AI Startups Alice and Gaze Receive Foreign Funding Amidst the COVID-19 Pandemic	18
III. Local Government’s Funding of AI Startups	18
Canada.....	20
I. BlueDot: Flagging the Pandemic First	20
II. TD Canada Trust: Helping Mitigate Financial Stress.....	20
III. EIAGLE: Vaccine Passport Management	20
Chile	21
I. Chile’s First National Artificial Intelligence Policy.....	21
II. Policy Axes	22
III. Cross-Cutting Principles.....	22
IV. Action Plan.....	23
Colombia.....	25

I.	SuperSociedades' Better Citizen Services	25
II.	AI Facilitating the Early Detection of Leukemia	25
III.	VigIA to Watch Public Contracts	26
	Germany.....	27
I.	Thyssenkrupp Elevator's Predictive Maintenance Platform MAX	27
II.	Logivations' SARS-CoV-2 Occupational Health and Safety Standard	27
III.	app@work's Tool Sandman.MD and EU Horizon 2020 Project ENVISION	28
	India	29
I.	Introduction.....	29
II.	AI-enabled Technology Powered India's Response to the COVID-19 Pandemic	29
III.	COVID-19: AI for Fighting Misinformation.....	31
IV.	Risk Stratification Algorithms for COVID-19 Patients	32
V.	Conclusion	34
	Italy	36
I.	The AIforCOVID Imaging Archive.....	36
II.	Almawave Iride Call: Natural Language Processing and AI for the Public and Private Sector.....	36
III.	Vera: Conversational AI Assistant to Fight Misinformation During the COVID-19 Emergency.....	37
	Mexico	39
I.	Context	39
II.	iRx: Radiografías por México (Radiography for Mexico).....	39
III.	Mexican Universities Embrace AI Innovation.....	40
IV.	Post-Pandemic Reactivation.....	41
	Nigeria.....	42
I.	Flutterwave Assists SMEs.....	42
II.	Government Initiatives Embrace AI	42
III.	Wellvis Creates COVID-19 Triage Tool	43
	Philippines	45
I.	AI Strategy Roadmap.....	45
II.	Support for Research Activities of Startups	45
III.	Using AI for Health	46
IV.	AI-powered Thermal Scanning Drones	46
V.	Online Community Monitoring	47
VI.	AI and Business Process Outsourcing (BPO)	47
	United Kingdom.....	48

I. Chest Imaging Database Helps Focus COVID-19 Patient Care 48

II. The AI-led Vision Taking Smarter Eyesight Monitoring ‘Home’ 48

III. Navenio—Intelligent Software for Indoor Locations..... 49

United States..... 51

I. Amazon Scout’s Automated Delivery Service 51

II. Erica: Bank of America’s Virtual Assistant..... 51

III. DataRobot Assists the Government’s COVID-19 Preparedness..... 52

San Francisco/Silicon Valley 54

I. Distance Communication 54

II. Telehealth 55

III. Fintech 56

IV. Connected Devices and AI Infrastructure 57

Conclusion 59

Endnotes..... 60

Introduction

The Global Trade and Innovation Policy Alliance (GTIPA) represents a global network of over 40 independent, like-minded think tanks from 27 economies throughout the world who believe trade, globalization, and innovation—conducted on market-led, rules-based terms—can maximize welfare for the world’s citizens. The Alliance exists to collectively amplify members’ voices and enhance their impact on trade, globalization, and innovation policy issues while introducing new scholarships into the world on these subjects.

Among their shared principles, GTIPA members are committed to approaching globalization and trade through an innovation-based perspective. This is because the creation of new or the improvement of existing processes, products, services and business models drives economic expansion as well as sustainable development. One driver of such innovation has been the advent and development of artificial intelligence (AI). GTIPA recognizes the role AI plays as both a product of innovation and a vehicle for future progress.

This report provides GTIPA members’ perspectives on how the COVID-19 pandemic has inspired AI-driven innovations in their countries. The report consists of informative vignettes on how new start-ups, existing companies, and government agencies have leveraged AI or machine learning to develop products or solutions that have helped usher global society through the pandemic. The volume compiles briefs from Argentina, Australia, Austria, Bangladesh, Canada, Chile, Colombia, Germany, India, Italy, Mexico, Nigeria, the Philippines, United Kingdom, United States, and the San Francisco Bay Area.

What is Artificial Intelligence?

Artificial intelligence is a branch of computer science committed to developing computer systems that perform tasks characteristic of human intelligence, such as learning and decision-making.¹ Within AI, machine learning represents a specific subfield focused on building systems that can learn and improve from experience rather than being programmed with specific solutions.

The development of improved hardware in the last decade has unlocked a variety of new applications for AI, such as:

- **Monitoring:** AI can rapidly analyze large amounts of data and detect abnormalities and patterns.
- **Discovering:** AI can extract insights from large datasets, often referred to as data mining, and discover new solutions through simulations.
- **Predicting:** AI can forecast or model how trends are likely to develop, thereby enabling systems to predict, recommend, and personalize responses.
- **Interpreting:** AI can make sense of patterns in unstructured data such as images, video, audio, and text.
- **Interacting:** AI can enable humans to more easily interact with computer systems, coordinate machine-to-machine interactions, and engage directly with objects.

AI represents a “general purpose technology” affecting most functions within an economy. It can induce more-efficient processes and higher-level outputs by increasing the level of automation across a wide range of sectors. By addressing a multitude of objectives, such as improving logistics,

detecting and responding to cybersecurity incidents, and analyzing enormous volumes of data, the technology has extremely large impact on routinized information-based and physical functions.

ITIF has identified at least three important policy implications of AI:

1. Governments should develop strategies to promote AI innovation, such as through targeted research and development (R&D) funding, accelerate the use of AI in the public sector, and support its use in sectors with public oversight, such as education, finance, healthcare, and transportation.
2. Governments should follow the “innovation principle” rather than the “precautionary principle” and address risks as they arise or allow market forces to address them rather than allow speculative fears to hold back progress through undue regulatory policies.
3. Governments should assist those affected by the occupational disruption of AI by helping workers make successful transitions and encourage educational reform focused on teaching “21st-century generic” and technical skills.²

COVID-19, Innovation, and AI

According to the Global Innovation Index 2021 (GII), investment in innovation has shown resilience during the COVID-19 pandemic; however, this has varied across sectors and regions.³ By observing the number of publications released in 2020, the GII found AI to be one of the fastest growing research fields globally.

Additionally, an Organization for Economic Cooperation and Development (OECD) brief on the effects of COVID-19 on the future of science, technology, and innovation (STI) found that the accelerated adoption of digital tools and techniques would help shape the future of STI.⁴ That brief identifies the central role of STI in addressing both the immediate and sustained effects of the pandemic as well as the resulting economic downturn; it recommends that the public sector offer greater funding to strategic technology domains, such as AI, which have a part to play in enhancing preparedness for future challenges.

Summary and Highlights of GTIPA Contributions

As demonstrated by the contributions to this report, businesses and policymakers in GTIPA member nations recognize the growing importance, impact, and potential influence of AI technologies, particularly in responding to COVID-19 challenges. The COVID-19 pandemic highlighted the need for increased and deeper digitalization efforts by both the private and public sectors.

As the public health crisis unfolded, AI paved the way for advancements in patient diagnosis, treatment, monitoring, and care. In Australia, the University of Sydney partnered with startup DetectED-X to develop an improved breast cancer detection technology which was successfully modified to recognize COVID-19. The Wellvis COVID-19 Triage app from Nigeria helped users assess their risk of infection, while a partnership between the Council of Scientific and Industrial Research, Intel India, and the International Institute of Information Technology, Hyderabad assisted in providing faster and cheaper testing as well as coronavirus genome sequencing. Similarly, Argentina’s EntelAI Pic used AI to analyze chest X-rays and detect suspected cases of the virus while Austria’s KML Vision established a program that automates COVID-19 detection through X-ray imagery.

In the wake of the pandemic, hospitals experienced an influx of patient admissions and an increased need for services. AI has been used to ease and assist the work of medical professionals, such as Sandman. ICU from Germany, which collects 24-hour data regarding COVID-19 patients and creates patient-specific predictive models of how the disease may evolve in the patient and how care can optimally be provided. Another example is Italy's AlforCOVID AI algorithm, which is capable of analyzing radiological and clinical data to predict (and ideally help improve) clinical outcomes. With the use of AI-powered motion tracking, the UK-based company Navenio tracks hospital workers' movements so that staff can be deployed effectively and reassigned when necessary. The United Kingdom has also developed an AI-enabled chest imaging library to enhance patient assessment. In Mexico, an affordable respirator was developed by alumni from the University of Monterrey. Additionally, Mexican developers have produced a telemedicine platform called IRx that offers accessible and speedy responses to COVID-19 cases as well as an AI-based platform that predicts the number of infected individuals and hospitalization rates. Other North American companies in both the United States (DataRobot) and Canada (BlueDot) have used big data to track, locate, and conceptualize infectious disease spread, at times down to a county level. In San Francisco, telemedicine provider Doctor on Demand saw demand for its virtual appointment service grow rapidly during the pandemic and, in 2020, the company teamed with Humana to launch a primary care option.

In many countries, easy access and proliferation of accurate information has been vital in the fight against the coronavirus. By teaming with IBM's AI-based Watson Assistant, the Indian Council of Medical Research developed a virtual chat-bot to assist with questions related to the pandemic. Similar endeavors were executed in Italy, as the "Vera" AI project helped citizens recognize fake news related to COVID-19 and Almagest Iride used advanced technologies to assist contact center operators with managing user requests and questions regarding the pandemic.

Public safety measures affected the operations of many businesses. In Canada, EIAGLE adapted its technology to help facilities and workplaces reopen by improving automated visitor and capacity management, wellness screening, crowd monitoring, and face mask-wearing compliance detection. German technology firm Logivation developed AI-based tracking solutions to monitor and enforce social distancing mandates. Using CCTV contributions, the Filipino initiative Project Greengrass developed an online community map for real-time monitoring of street activities to identify areas of high concentration and COVID-19 curfew violations. Distancing also played a role in popularizing contactless delivery, as Amazon expanded its fleet of Scout sidewalk delivery robots to meet increased customer demand.

Within the financial services industry, banks such as Gala in Argentina and Bank of America in the United States improved their virtual assistant features to meet the increasingly sophisticated needs and inquiries of customers. TD Canada deployed AI in an app that notified customers likely to face financial stress due to the pandemic and preemptively offered emergency relief options. In Nigeria, mobile payment startup Flutterwave saw an increased need for its digital payment services, particularly for smaller and medium-sized enterprises (SMEs) which were provided a one-stop-shop for e-commerce. Other startups, such as the San Francisco-based digital payment company Stripe and Bangladesh-based customer service app Alice Lab further improved and expanded their services.

In order to promote continued and sustainable development of advanced-technology solutions, several governments introduced AI-focused policies and schemes. Australia's AI Action Plan is

focused on AI adoption for job creation, talent attraction, problem-solving, and responsible AI use. The Australian government also invested almost \$800 million through a JobMaker Digital Business Plan to encourage businesses to take advantage of digital technology. Bangladesh has announced a National Strategy of AI in order to make itself a more-digitalized nation, focused on incubating domestic AI opportunities. The Philippines' Department of Trade and Industry launched an AI strategy roadmap in 2021 and found digitalization and infrastructure, R&D, workforce development, and regulation to be among the most important dimensions for AI readiness. In August 2020, the *AI Mission Austria 2030* was published, providing a robust framework for developing new AI-based technologies. In Nigeria, the Centre for Artificial Intelligence and Robotics was inaugurated in 2020 to promote emerging technologies and prepare for the so-called fourth industrial revolution. The Ministry of Science, Technology, Knowledge and Innovation in Chile also introduced a National Artificial Intelligence Policy which includes an AI work plan and strategic guidelines to empower people to use and develop AI tools.

Public services have also benefited from AI adoption, such as India's MyGov Corona Helpdesk, which provides 24/7 accurate information in multiple languages. In Argentina, the AI system Prometea streamlined judicial processes at a time when staff was reduced due to health measures, while Colombia's VigIA uses AI to identify irregularities, inefficiencies, and corruption contracts signed by the government of Bogotá. SuperSociedad, a technical body attached to the Colombia Ministry of Commerce, Industry, and Tourism, has combined AI, cloud computing analytics, and big data to create an integrated information system.

Looking ahead, there exists determination in all sectors to continue the research, development, and implementation of AI technologies. The Austrian Council on Robotics and Artificial Intelligence published a paper identifying AI fields in which funding and attention should be focused and highlighted the importance of European Union (EU) cooperation and technology utilization in fostering competitiveness. In Mexico, the Science and Technology Council is committed to developing a National Computer Science Ecosystem for enhanced knowledge generation on complex systems and AI, while a variety of education, training, and digital tool familiarization programs have been proposed by national universities. From detecting elevator maintenance needs in Germany to developing thermal scanner drones for disaster assistance in the Philippines or harnessing Internet of Things (IoT) data to improve business operations in the San Francisco Bay Area, the opportunities for future AI application are endless.

This collection of reports offers examples and lessons from global AI adoption and innovation in the wake of the COVID-19 pandemic. Each country has uniquely embraced advancements in AI technology and policy from best practices witnesses around the world. We hope this volume highlights that international support of policies stimulating innovation and supporting high-tech initiatives within the private and public sectors is key for the responsible harnessing of AI and leveraging it to help solve ongoing and future challenges. We hope this volume can be a guide for AI policymakers and solutions developers alike in countries throughout the world.

Argentina

Federico N. Fernández, Fundación Bases

I. Gala: Galicia Bank's Virtual Assistant

The COVID-19 pandemic has had a strong impact on Latin American economies, and an even stronger one in Argentina.⁵ There, the Argentinean government's response to the virus included the imposition of strict, prolonged, and atypical quarantines that meant an abrupt decrease in the face-to-face consumption relationship between consumers and companies.⁶

In this context, the main banking institutions in the country were forced to accelerate the online banking and automation processes they had been developing for some years with the help of AI and machine learning. One of the most emblematic cases is that of Banco Galicia, one of the most-traditional financial institutions in Argentina, with 2.7 million customers and 326 branches throughout the nation.⁷ During the pandemic, Galicia Bank put its main customer service project to the test: the virtual assistant Gala, which sought to assist increasingly demanding customers and effectively manage communication in order to obtain the highest levels of online satisfaction.

Gala is a chatbot that since September 2017 has been operational on the institutional web. In 2018, Facebook chose Galicia as the first bank in the country to do beta testing of WhatsApp for Business, where Gala was incorporated, and in 2020 the virtual assistant was integrated into Online Banking and Office Banking.⁸ As a result, Gala is now available across five channels. This chatbot is designed to answer queries from customers and non-customers, providing information on more than 200 topics related to products, services, and customer management, among others, and referring these queries to the different self-management systems. One of the most-outstanding features of this AI system is that its algorithms can be trained to learn and improve through its use, allowing employees to free themselves from repetitive and tedious tasks, thus increasing productivity, a fact that is not trivial considering that during the pandemic the average volume of queries received through the chatbot tripled.⁹

In addition, this project has an interesting achievement record: it was a finalist in the 2018 edition of the Planet Chatbot Awards and winner in the 2020 edition. There, the members of the jury included experts from companies such as Google, IBM, Microsoft, Chatbot Chocolate, and Amazon, which assessed four fundamental aspects among the finalists: cognitive capacity; innovation in the sector; user experience; and fulfillment of the functionality for which it was created.¹⁰ In the next few years, Gala is expected to be integrated with Google Assistant and thus be able to engage in voice conversations.¹¹

II. EntelAI Pic COVID-19

The health emergency resulting from the COVID-19 pandemic put health systems around the world to the test, especially in Argentina, which is why innovation in the medical industry had to be accelerated, so that technology could be of assistance to accommodate the strains put on the health system. In this sense, one of the projects that contributed significantly to this task was EntelAI Pic, an automated medical image analysis software that connects to servers with image information, and

through AI algorithms analyzes these images to detect and measure anomalies and produce a standardized report to support the medical professional.¹²

The individuals responsible for this innovation include Ph.D. in computer science and professor at the University of Buenos Aires, Diego F. Slezak, and the specialist in neurology, and Master of Public Health at Harvard University, Mauricio Farez, who at the end of 2017, after three years of collaboration together, founded EntelAI. The company, which is based in Buenos Aires and has offices in Chile and Brazil, launched EntelAI Pic initially with the aim of analyzing brain MRIs and mammograms and worked for a while to incorporate chest X-rays and abdominal CT scans. The product improves the detection of lesions by 40 percent and resolves in a few minutes what could take a doctor without this type of technology hours. In total, the system reduces diagnostic time by more than 90 percent.¹³ In addition, it allows for more accurate detection of changes in brain size that may indicate the presence of neurodegenerative diseases such as Parkinson's or Alzheimer's, and lesions associated with demyelinating diseases such as multiple sclerosis. The technology helps identify diseases when they previously would likely have been undetectable, with detection capacity increasing from 20 to 99 percent.¹⁴

Following the pandemic, the founders decided to retrain the algorithms to make them available for free on their website for all medical professionals worldwide. The product "EntelAI Pic Covid-19" has become an AI tool that contributes to the detection of suspected cases of COVID-19 by analyzing chest X-rays: in less than one minute it analyzes the X-rays and indicates a conclusion that allows medical professional to differentiate positive cases of coronavirus from those with other pneumonias or without findings compatible with pneumonia.¹⁵

The company was selected by Endeavor to be part of its Scale Up Program, for its degree of innovation and growth potential; it was a winner of Novartis' Innovation Week 2018; and received an award for innovation in healthcare, given by the Ministry of Science and Technology and the German company Merck.¹⁶ The future prospects of artificial intelligence and machine learning applied to medicine are truly amazing, and it's expected that many more projects like this will emerge in the coming years: projects that will optimize and make more efficient use of resources as well as lengthen life expectancy thanks to the earlier detection of diseases.

III. Prometea

It's common to see in the private sector multiple organizations engaged in AI developments with the aim of achieving greater efficiency in their processes, but the case of Prometea in particular does not come from the private sector, but the public one. From the Artificial Intelligence Laboratory of the University of Buenos Aires (UBA), Prometea represents an initiative carried out in conjunction with the Public Prosecutor's Office of the City of Buenos Aires which performs prediction and automation tasks and can solve a large number of simple cases of the Argentine judicial service in a very short time.¹⁷ Prometea was put into operation in August 2017.

The operation of this system consists of taking the data of a requested case, identifying it and comparing it with more than 300,000 previous documents linked to the file, where from there it relates the patterns with the previous opinions and in only 15 seconds it predicts which is the solution to be adopted.¹⁸ As a result, opinions are issued on 52 percent of the cases that enter the

Superior Court of Justice of Buenos Aires, with a 96 percent accuracy rate. What used to take more than 83 working days can now be resolved in 7 days.¹⁹

Although the program has been in place for several years, it has found great utility and growth in times of the pandemic. Streamlining the highly bureaucratic judicial processes was a particularly necessary feature in the year 2020, in a context where much of the judicial staff was reduced by the health measures imposed as a result of COVID-19 pandemic and the demands for judicial services were increasing as a result of the significant economic crisis that the country was going through there.

Currently, more than 60 national and international organizations and institutions have used this software in some of their tasks, including the United Nations, the Organization of American States, the University of Oxford, the Inter-American Court of Human Rights, and the Constitutional Court of Colombia, among many others.²⁰

The team that created Prometea, led by Juan Gustavo Corvalán—attorney general who also has a specialization in machine learning from the Massachusetts Institute of Technology (MIT)—and integrated by Luis Cevasco, Ignacio Raffa, and Nicolás Vilella, emphasizes that the application of this tool does not mean the replacement of human labor, but rather it solves those routine and repetitive tasks to provide assistance to the real people who finally make the decisions.²¹

Australia

Professor Syed Munir Khasru, The Institute for Policy, Advocacy and Governance

I. Slowdown in Machine-learning Adoption

Machine learning is the computer intelligence responsible for imitating human behavior through studying numerous relevant data to identify a pattern. This is one of the main reasons machine learning requires a substantial scale of data and algorithms that represents human behavior. Historical data sets are used to build models to identify the desired pattern, changes, or event which helps to improve a decision-making process.²²

As COVID-19 hit the entire world, Australian organizations started shutting down planned projects—disrupting numerous ICT projects, including AI and machine learning projects. Some organizations were even forced to repurpose project budgets for survival during the pandemic, rather than meeting project objectives. AI has already been quite widely adopted by the Australian business community. Banks are using AI to identify fraud and compliance risks; businesses are using AI to organize schedules, improve the workplace environment, and make better decisions, and even hospitals are using AI for better and more efficient diagnosing of diseases.²³

There is no doubt the COVID-19 pandemic pushed Australian businesses toward an accelerated digital transformation, which creates its own challenges. Many businesses, particularly small businesses which are just at the initial stage of their digital transformation journey, are not aware of AI technological development. These unaware businesses can rarely utilize their data through AI solutions. A report by the Australian Institute of Company Directors (AICD) hinted how Australian directors were struggling to drive innovation due to the lack of talented individuals with adequate digital literacy to understand the implications of AI. Communication barriers and a shortage of professionals are leading to a stagnant adoption of AI across Australia.²⁴

II. The Australian AI Action Plan and Other Government Initiatives

The Australian government had been supporting AI long before the COVID-19 pandemic shook the world. Investment in AI currently stands at half a billion Australian dollars since 2018 according to a recent budget published by the Department of Industry, Science, Energy and Resources of the Australian Government.²⁵ The Commonwealth Scientific and Industrial Research Organization (CSIRO) has been applying cutting-edge AI into multiple research tasks ranging from technology-driven agriculture to smart energy grids and even in improving manufacturing efficiency. The organization has been collaborating with more than 30 utilities from around the world in perfecting data-driven analytics technology to predict pipeline failures more accurately.²⁶

Australia's Artificial Intelligence Action Plan developed by the Australian Government sets out a unique vision for Australia in an aim to lead the development and adoption of trusted, secure, and responsible AI, including plans to build Digital Capability Centers and launch a National AI Centre. The plan developed during the pandemic focuses significantly on four areas: 1) AI adoption for job creation and to boost productivity; 2) grow and attract world-class talent and expertise; 3) harness Australia's world-leading capabilities to solve national challenges and benefit all Australians; and 4)

to ensure that the AI technologies being used are responsible, inclusive, and reflect Australian values.²⁷ The country also announced a broad technological plan called the Digital Economy Strategy which discusses the plan to drive the whole digital economy including AI.²⁸

The government is highly interested in developing the AI infrastructure of the country, reflected in the 2020-21 budget: establishment of four Digital Capability Centers to lay the foundations of the Australian AI and digital ecosystems. The centers are being built with the aim to help drive the business adoption of AI technologies.²⁹ The government is also establishing the National AI Centre, which would support projects that improve business capability through AI, enable industry and academic (or researcher) collaboration, and cater to strategically aligned work capacity across the whole Australian AI ecosystem. The AI Centre is expected to be funded at \$50 million and will be established under the auspices of CSIRO.³⁰

III. University of Sydney and DetectED-X Improved COVID-19 Diagnosis Using AI

In Australia, AI was popularly used in hospitals in assisting diagnosis of diseases such as cancer much more efficiently. AI is also being used for in-vitro fertilization (IVF) by doctors to select the most viable eggs. Even aged-care facilities are using AI in sensors to efficiently detect and alert if any of the residents are in danger or require immediate assistance.

AI has been used in multiple medical diagnosis in Australia. One of these initiatives was the affiliation between the University of Sydney and the startup DetectED-X that led to the development of a technology to improve the accuracy of breast cancer detection. Subsequently, this technology has been successfully modified to detect COVID-19 using lung CT scans of patients. The Australian-designed breast cancer diagnostic tool has seen significant improvement in its ability to diagnose breast cancer, according to a 2016 study.³¹

DetectED-X was not the only AI firm to repurpose its technology in an attempt to combat the COVID-19 global pandemic. Google's Deepmind has successfully predicted the protein structure of the COVID-19 virus. CSIRO's Australian e-Health Research Centre is currently using the machine to identify possible strains of the virus on which vaccines will be tested.³²

IV. The Role of AI in Australia's Economic Recovery From COVID-19

AI will likely contribute significantly toward Australia's economic recovery from the COVID-19 pandemic. The Australian Government is investing almost \$800 million through the JobMaker Digital Business Plan to help businesses take advantage of digital technology according to the 2020-21 Budget of Australia. The plan is supposed to create jobs to aid in Australia's economic recovery.³³

Lockdowns set up for preventing COVID-19 spread have been damaging the economy for a long time which is why AI is being introduced to efficiently track and trace through mass tests so that only the affected are quarantined instead of nationwide lockdowns in order to minimize the economic impact of lockdowns. Projects in Australia are currently underway to aid beneficial community behaviors to prevent further spread through AI-assisted applications that can help track the spread of the disease. AI-driven tools are analyzing data regarding COVID-19 spread and assisting in post-COVID policymaking and research initiatives. AI is also helping retailers respond to disruptions of supply chain to prevent further crisis, and also to prevent the spread of fake news.³⁴

Austria

Scott B. Nelson, Austrian Economic Center

Artificial intelligence and machine learning have the potential to increase productivity and effectiveness in many aspects of our lives. Their role in governmental and industrial processes is becoming crucial in the information age. Many countries of the EU have identified the important role of AI and have called for regulation and uniform frameworks in the past years.³⁵ As a result, in April 2021 the European Commission presented a proposal for a European regulation of AI.³⁶ Whatever the outcome of the proposal, it will have a major influence on the development of AI in the EU's member states.

I. Austria's Artificial Intelligence Mission

While it might take a while before the European Commission and the EU members agree on an EU-wide regulation—and another couple of years before it goes into effect—most European countries are already planning and financing national AI programs.³⁷ After several studies on the potential uses of AI, the Austrian government published its official position in August 2021, the *Artificial Intelligence Mission Austria 2030*.³⁸ Between 2012 and 2017 Austria had already invested over €380 million (\$430 million) in AI research. Considering its August 2021 position, the Austrian government looks set to provide a robust framework for the development of new technologies.³⁹ Mission Austria aims to achieve three principal goals by the year 2030:

- Austria should become an attractive research and innovation hub for the development of key AI technologies;
- AI is to ensure the competitiveness of Austria's technology and economic sector;
- Regulatory frameworks for AI technologies need to be developed. These frameworks need to comply with fundamental European values and future EU legislation.

II. Focus on the Health Sector: AI Against COVID-19

According to the government, around 230 Austrian companies are active in AI, knowledge representation, robotics, and autonomous systems.⁴⁰ Most of these are software developers focusing on business and marketing consulting. While companies are essential players in the implementation of AI and machine learning in Austria, it was research facilities that played the decisive role during the pandemic. Although the pandemic boosted the rapid adoption of AI-based tools in the economic sector in other countries, in Austria the health sector saw the most benefits.

During the pandemic, the Institute for Machine Learning at the Johannes Kepler University in Linz (JKU) researched possible SARS-CoV-2 inhibitors. The institute used its past knowledge in the development of pharmaceutical drugs to program the AI-based *ChemAI* to screen and rank one billion molecules from the *ZINC* database in only a couple of days—a process that otherwise would have taken years without the help of AI.⁴¹ Through this research, it was possible to pinpoint molecules from the database that could have a favorable effect against CoV-2. Scientists could then identify

the 30,000 top-ranked compounds and create a new database, which is available for other scientists around the globe to use.⁴² Scientists are already capable of identifying molecular structures that might be toxic to humans, and the new technology enables them to “feed” this information to the AI program, so it can trace similar patterns in different databases. Scientists are searching for molecules capable of blocking certain proteins necessary for the multiplication of the COVID-19 virus in our bodies. The program is then capable of predicting which molecules might have the needed properties to hinder the link between these proteins.⁴³ AI and digitalization not only helped speed up the research of possible inhibitors, but they also enabled scientists to easily share information and their findings. Prof. Dr. Klambauer from the JKU states that “in the battle against Corona, it is necessary to make our data available worldwide. It is a key factor for us to share our knowledge with those who are working on pharmaceutical drugs and compounds. The more we know where to look for alternatives, the faster we can advance our research”.⁴⁴

During the pandemic, Austrian research institutes have been among the leading facilities in the field. Innophore, a start-up from Graz, has also used AI and supercomputers to screen databases and identify active ingredients that might render the SARS-CoV-2 pathogen harmless.⁴⁵ Scientists have developed a platform that enables the identification of enzymes and active ingredients from databases through computer-based algorithms. This process significantly reduces the time needed and is more effective than conventional research. As a consequence of the ongoing pandemic, the start-up has become a research partner with the Chinese Center for Disease Control and Prevention.⁴⁶

Innophore together with the University of Graz and the Austrian Centre of Industrial Biotechnology are now working on a project led by Harvard University to screen various databases in search of active ingredients that could combat the novel COVID-19 coronavirus. The novelty in this project’s approach is in the computer-aided method used to screen all the individual agents, which leverages Harvard’s *Virtual Flow* technology.⁴⁷ The start-up supports the *Virtual Flow* program by using its patented 3D point cloud technology to simulate various starting points and then filter them using AI. The project has the support of Alphabet, which provides the scientists with unlimited Google Cloud computing power. As Christian Gruber, CEO of Innophore, explains, “In virtual drug discovery at this scale, the biggest challenge is not only to obtain the data for these billions of compounds, but also computing power. At the moment we assume that we have to perform more than 100 billion individual computations as every potential compound is being screened individually. We are delighted to receive Austrian and international support from the Vienna Scientific Cluster and Alphabet, respectively.”⁴⁸

KML Vision, another company in Graz, has also used AI to contribute in the fight against SARS-CoV-2. The Austrian company has developed a program that automatizes the detection of COVID-19 in C-ray images, based on an AI program published by the University of Waterloo.⁴⁹ In just seconds, the program can identify in lung C-rays if they have pneumonia or COVID-19. Philipp Kainz, CEO of KML Vision, sees global collaboration as a key element in research toward finding new, more efficient solutions in the health sector.⁵⁰ For this reason, the company has made its program available through their online platform IKOSA.⁵¹ By providing easy access to its application, the company hopes to speed up the research of new treatments and diagnostic procedures of COVID-19 and other diseases.⁵²

III. COVID-19 as a Catalyst for Research

While Austrian society might not yet be prepared for the same level of automatization as some Asian countries, the pandemic has served as a wake-up call for the Austrian government and private companies.⁵³ The pandemic has highlighted the important role of technologies that allow remote control and remote maintenance of industrial equipment.

The Austrian Council on Robotics and Artificial Intelligence (ACRAI) published a paper in which the current pandemic and future steps for the development of AI in Austria are discussed.⁵⁴ The paper points out the importance of cooperation within the EU and the need to pursue a higher degree of autonomy from global supply chains. In order to develop a crisis-proof European supply chain that keeps its competitiveness in the long term, a Pan-European strategy is recommended.⁵⁵ Furthermore, European cooperation would foster the sharing of regional know-how and create synergy between European industries. The pandemic has also shown that the use of robots in public and private spaces will rise. In this area, cooperation between European countries is essential since the development of new technologies must follow existing EU regulations, notably the General Data Protection Regulation (GDPR), which will play a key role in Europe in the further development of AI-based technology.⁵⁶

The Fraunhofer Institute, another research facility in Austria, mentions the potential use of AI technologies for tracking the effectiveness of non-pharmaceutical measures during a pandemic, like travel restrictions, school closures, and mandatory face mask-wearing.⁵⁷

Because of the pandemic, the ACRAI could identify seven different AI fields in which research funding, public attention, and development should be focused, to ensure a certain level of stability facing future global challenges. AI technology and machine learning could be used to: 1) improve remote work (home-office); 2) combat the spread of disinformation and fake news; 3) help in the diagnosis of COVID-19 in X-ray images and CT scans; 4) early detection of diseases; 5) prognosis and tracking of the natural history of diseases; 6) speed up the research of active ingredients for pharmaceutical compounds; and 7) improve the processing of requests and forms in public and private institutions.⁵⁸

Bangladesh

Professor Syed Munir Khasru, The Institute for Policy, Advocacy and Governance

I. The Government's Incubation of Local AI Development

Bangladesh has already invested heavily in developing digital infrastructure that improves the capability of AI developments along with other ICT services. This includes about 16 Hi-Tech Parks, 7 Technology Parks, 12 IT Training & Incubation Centers, a Tier-IV Data Center, and even launched its own satellite in 2018. Before the COVID-19 pandemic hit, Bangladesh's ICT Ministry introduced the National Strategy for Artificial Intelligence Bangladesh for the years 2019 to 2024. The strategy advances a plan for a more-digitalized nation with the slogan "AI for Innovative Bangladesh."⁵⁹

The strategy, spread over six years, focuses on a range of areas that would positively incubate AI opportunities within the country. The plan extends from building an AI task force, creating awareness, improving digital infrastructure, accumulating a venture capital (VC) fund, developing global R&D affiliations, and much more. The actions proved to be successful, as almost 26 AI startups have been founded out of Bangladesh.⁶⁰

II. AI Startups Alice and Gaze Receive Foreign Funding Amidst the COVID-19 Pandemic

One of the Bangladeshi AI startups is Alice Lab, which launched an AI-driven app that caters to multi-channel customer service for e-commerce and online businesses. The startup has developed smart tools and conversational AI solutions to automate customer service operations.⁶¹ Alice Labs is currently operating in the South Asia and Southeast Asian including countries such as Bangladesh, Myanmar, and Nepal, serving over 50 e-commerce brands such as Unilever, Coca-Cola, Giordano, and Maybelline. The conversation-automating app MyAlice was created using natural language processing (NLP) and machine learning technologies by Alice Labs. The startup received \$500,000 of funding in early 2021.⁶²

Gaze is another AI service providing innovative API solutions to the global market. Taus Noor, a former IBM employee, co-founded Gaze, which makes AI-powered intelligent video analytics software for variable uses ranging from CCTV camera-based traffic monitoring to visual recognition. Thus far, Gaze has attracted \$830,000 in funding.⁶³ Gaze is currently working with the Dhaka Metropolitan Police to help improve its monitoring system.

III. Local Government's Funding of AI Startups

Startup Bangladesh Ltd., a flagship venture capital fund developed by the ICT Ministry of Bangladesh, is also desperately trying to support local tech businesses—even AI startups. The government-backed VC company has announced it will invest about BDT 15 Crore (\$1.75 million) into Intelligent Machines, another AI-based startup in Bangladesh. Startup Bangladesh announced a total of BDT 100 Crore (\$11.76 million) for 50 startups as part of its economic recovery plan in the post-COVID world.⁶⁴ Intelligent Machines uses AI for language, trade marketing, and enterprise

analytics. The startup has been popularly serving large multi-national corporations (MNCs) and local Bangladeshi companies including Unilever, Bkash, and even Telenor Myanmar from Myanmar. The company's technology has improved the productivity of these companies quite significantly.⁶⁵

Canada

Aaron Wudrick, Macdonald-Laurier Institute

I. BlueDot: Flagging the Pandemic First

BlueDot, a Canadian AI platform, was among the first in the world to identify the emerging COVID-19 crisis, a full nine days before the World Health Organization (WHO) declared it a global pandemic.⁶⁶ Epidemiologist Kamran Khan had treated patients in Toronto during the SARS outbreak in 2003 which inspired him to start BlueDot as a way to use technology to better manage infectious outbreaks.

BlueDot tracks, locates, and conceptualizes infectious disease spread with big data, using NLP and machine learning to cull information from a vast array of sources, including official public health statements, social media, airline ticketing data, livestock health reports, and population demographics. A group of physicians and computer programmers review the AI findings, and if they concur, finalize reports that are sent out, meaning that AI is used to supplement rather than replace human intelligence

BlueDot was also able to identify cities that were highly connected to Wuhan to help anticipate where the infected might be traveling, and in the end 11 cities at the top of their list were among the first to identify cases of COVID-19.

II. TD Canada Trust: Helping Mitigate Financial Stress

One of Canada's largest banks deployed an app in the early months of the pandemic that used the predictive capabilities of AI to alert customers likely to be facing financial stress to a number of options available to assist them, including emergency relief programs being rolled out by governments.⁶⁷

The app uses more than 100 different variables including account balances, transaction patterns, and government support received to tailor advice and flag prospective concerns for clients.

III. EIAGLE: Vaccine Passport Management

An AI company originally focused on water management solutions, EAIGLE pivoted during the pandemic to adapt its technology to helping facilities and workplaces reopen. The company now provides automated visitor management, wellness screening, crowd monitoring, face mask detection, and venue capacity management.

In August 2021 EIAGLE announced the launch of a new proof of vaccine platform to assist businesses implementing vaccine passport requirements implemented by various Canadian governments.⁶⁸

Chile

Natalia Gonzalez, *Libertad y Desarrollo*

I. Chile's First National Artificial Intelligence Policy⁶⁹

The growing digital transformation, which was boosted, among other factors, by the arrival of the pandemic, has driven increased investment toward technologies such as AI to automate certain operations which have become more difficult to carry out during the current health crisis. The pandemic aside, AI represents a tremendous opportunity for mass consumption industries since it provides a space to generate an ecosystem of solutions promoting collaboration between companies using this technology. AI also has the potential to raise the level of solutions available and provide tools for better decision-making processes, while also representing an opportunity for new companies to challenge current incumbents.

In Chile's case, the application of AI could generate a percentage point of GDP growth by 2035 according to government reports (being progress measured by the existence of number of graduates, number of companies doing AI, subsidy policies, academic-company relationships, and startups that are created). A study by the *Centro de Implementación de Políticas Públicas para la Equidad y el Crecimiento (CIPPEC)*, entrusted by Microsoft, measured the qualities of countries in the region in terms of the development of technological advances that could increase productivity and generate new jobs. Increasing productivity in working hours, generating new jobs, and even helping to reduce the working day are some of the main scopes that the implementation of AI would have in different sectors of production in Chile during the next 10 years, in areas such as construction, trade, and public services, with quite favorable results for Chile. According to this study, Chile has a high capacity to accelerate the development and dissemination of AI, along with good conditions to increase participation in its benefits, which poses the ideal scenario for the development of this new technological paradigm. The report contends that if the potential of AI is fully exploited in Chile, from 18 to 42 percent of new jobs could be generated (i.e., at least in part through the application of AI solutions). Along with this, high-skilled jobs could increase to 54 percent. Along with increasing the number and quality of jobs, the study reveals that the country's productivity would also be highly benefited, tripling its growth by 2030, as workers will have the ability to produce the same in less time, thanks to the automation of certain tasks.⁷⁰

It is in this context, some months prior to the pandemic outbreak (August 2019), that Chile started a participative process to develop its first **National Artificial Intelligence Policy ("AI Policy")**.⁷¹ Led by the Ministry of Science, the AI work plan was accompanied by a collaborative and consultation process that included the participation of a committee of experts, an inter-ministerial committee and working groups in all the country's regions.⁷² The Chilean Congress was also involved through the Challenges of the Future Commission, which delivered to the government its proposals construed with the participation of more than 20 scientists. AI and other experts offered a diagnosis of Chile's situation in AI, along with proposals in the three areas of the work plan led by the Ministry of Science (enabling factors, development and adoption of AI, and the final area linked to ethics, standards, safety, and regulation of the use of these technologies).

On October 27, 2021, the Chilean Ministry of Science, Technology, Knowledge, and Innovation presented the Policy that contains the strategic guidelines to be followed by Chile over the next 10 years (through to 2030), aiming to empower people in the use and development of AI tools. The Policy serves as a roadmap (the current legal framework in Chile does not directly address key AI issues) for the development and adoption of this technology.

The Policy covers three pillars or axes and is based on several principles, listed below. The AI Policy is accompanied by an “**AI Action Plan**,” which specifies the initiatives included in each of the priority actions of the document, including those responsibilities and deadlines for implementation within the next decade:

II. Policy Axes

1. **Enabling factors:** Focuses on the development of human talent and capital, technological infrastructure, and data availability.
2. **Development and adoption:** Includes basic and applied research, technology transfer, innovation, entrepreneurship, improvement of public services, technology-based economic development, among others, to foster the use and development of AI which encompasses research, development, innovation, and entrepreneurship based on AI systems. It also fosters adoption in both the private and the public sectors.
3. **Ethics, regulatory aspects, and socioeconomic effects:** This includes discussions around human-machine interactions and some of the relevant regulatory aspects, for example, the relationship of AI to consumer cybersecurity, protection, privacy, etc. It also includes issues of explainability/transparency, responsibility, gender gap automation impacts, and consequences on the labor market.

III. Cross-Cutting Principles

1. **AI with a focus on peoples' well-being,** respect for human rights and security;
2. **AI for sustainable development;**
3. **Inclusive AI,** including an emphasis on the attributes of data integrity and quality in order to recognize and deal with possible biases. It also highlights the need to develop AI in an inclusive manner, not discriminating and incorporating a perspective of gender and cultural diversity, among others.
4. **Globalized and evolving AI:** Insertion of the country in the global context, promoting participation in bilateral and multilateral spaces, also aligning with agreements that Chile has signed (such as the OECD Principles on AI).

The AI strategy for Chile considers the country's specific challenges related to productivity, competitiveness, and employability. As it can be evidenced, the document mentions the OECD principles on AI and addresses its five recommendations for governments: 1) facilitate public and private investment in innovation and development to stimulate trustworthy AI development; 2) encourage AI ecosystems with digital infrastructure, and technologies and mechanisms able to share data and knowledge; 3) ensure a political background that leads to the deployment of trustworthy AI systems; 4) provide people with the necessary AI abilities and support workers for a fair transition; and 5) cooperate through frontiers and sectors to responsibly develop trustworthy AI.

The Policy covers different areas such as the economy, education, employment, public governance, and social and welfare issues. Direct beneficiaries should be higher education institutes, public research institutes, private research and development labs, established researchers, postdocs, and other early-career researchers, undergraduate and master students, secondary education students, Ph.D. students, teachers, firms of any size, incubators, accelerators, hubs, technology transfer offices, industry associations, academic societies/academies, national government offices, the labor force in general, plus civil society.⁷³

IV. Action Plan⁷⁴

The Policy is accompanied by an “Action Plan,” that gathers 70 priority actions and 180 initiatives to be developed during the 2021-2030 period, with impact on social, economic, and human capital areas, contemplating a public investment of \$32,000,000.

The Action Plan refers to the actions proposed, confirmed, in execution, and completed from different public services to implement the strategies of the Policy, organized, as in the Policy, along these axes: Enabling factors; development and adoption; ethics, normative aspects; and social and economic effects.

In labor-related issues, among other projects, it seeks to adapt and enhance certification or qualification instruments for skills related to AI, the promotion of scientific/technological-based ventures, and the promotion of training courses in this technology thanks to joint work with the Ministry of Labor, the Ministry of Economy, and CORFO (the Production Development Corporation of Chile), with the focus on increasing productivity in sustainable ways.⁷⁵

The action plan also includes the prioritization of the Chile Scholarship program, *Becas Chile*, in Ph.D.’s abroad for studying programs linked to AI; collaborative initiatives in R&D between universities and the productive sector; **and the generation of incentives and public-private alliances to insert professionals holding a Ph.D. in technological companies**

To turn Chile into a global hub in the southern hemisphere in terms of technological infrastructure, it will contribute to the acceleration of the deployment of the National 5G Connectivity System promoted by the Undersecretariat of Telecommunications of Chile, the increase in storage and processing capacity in Chile, and the generation of citizen connectivity projects.

At the school stage, creative skills and logical thinking will be fostered through educational resources that will be promoted by the Ministry of Education and specific areas and programs of the Science Ministry, the incorporation of these skills in the curriculum, the promotion of robotics and technology school clubs, as well as support for networks of training and collaboration of teachers in this context. In addition, concrete actions are contemplated to promote AI as a transversal tool in professional and technical-professional training.

The plan also seeks to create and consolidate an adequate governance of data in the government that promotes the availability and access to quality data in various matters of public interest, as has happened during the pandemic, as well as prioritize legislative projects for the responsible use of these technologies. Initiatives for the modernization of the State are integrated, with the use of AI for the protection of the environment and projects for the construction of a regulatory framework for ethical and regulatory aspects of AI.

It's also worth noting that the Chilean Congress is currently discussing a Data Protection Bill, which includes a right to oppose a specific treatment of personal data when an automated process is being applied. The bill is however in early stages of discussion.

Colombia

Nathalia Gamboa, TicTac

I. SuperSociedades' Better Citizen Services

The Superintendencia de Sociedades (SuperSociedades) is a technical body, attached to the Ministry of Commerce, Industry, and Tourism, with legal personality, administrative autonomy, and its own assets through which the Colombian president carries the inspection, surveillance, and control of commercial companies as well as the powers established by law in relation to other entities, including legal and natural persons.⁷⁶

In the context of digital transformation and the simplification of multiple procedures, barriers, and norms within the digital government, the SuperSociedades has implemented a solution that combines technologies such as AI, cloud computing, analytics, and big data to make easier and better for the users the open market information search, all free of charge.⁷⁷

The entity identifies all the data that has been collected in the past three decades (and the new data that enters daily), which is stored in on-premises data centers to be purged, organized in databases, uploaded to the cloud, or implemented in a data lake with data bases models which allow for quick and easy consultation of the needed information, creating the Sistema Integrado de Información Societaria (Integrated Corporate Information System), or SIIS.

With analytics, all the data lake is presented in an easy-to-consult platform that allows more than one million queries per minute.⁷⁸ Thus, the platform has a *Drill Down* system which first shows general information, and as the user continues navigating, can find more and more data from the societies, such as financial statements, comparisons between companies, regions, or sectors and other relevant material, centralized in one web page.

II. AI Facilitating the Early Detection of Leukemia

Arkangel AI is a company that seeks early detection of preventable sickness, and to give the same health conditions to all people in the world, all of this through an AI platform that detects disease before it's too late.⁷⁹

Today, 56 percent of the world's citizens perish from diseases that can be prevented but that simply aren't detected or prevented in time. Most viral diseases, such as malaria, affect the world's most vulnerable populations, where there is a huge inequality to the essential right to health. The problem is there's no early detection system fast enough, accurate and scalable to the size of the problem.⁸⁰

For the leukemia case, especially in children, diagnosis is a significant challenge, especially in low- and middle-income countries such as Colombia. In Colombia, around 41 percent of diagnosed children survive within five years, much lower than the 80 percent estimated for children in high-income countries.

So, in this regard, Arkangel AI developed a fast, affordable, objective, open-source code functionality to diagnose childhood leukemia named "*Hippocrates AutomaML*."⁸¹

The AI algorithm aims to automatically detect and classify lymphocytes in images of stained blood and bone marrow samples taken with a microscope. The solution has two main components:

1. A deep learning algorithm that identifies and segments the lymphocytes present in the patients' samples;
2. A deep learning classification algorithm that classifies the lymphocytes between normal-lymphocytes and abnormal-lymphocytes (lymphoblastoma).

In this way, if at the end of the patient's sample analysis, there are more than 20 percent lymphoblastoma cells, they will be classified as a leukemia patient.⁸²

In general, this solution can be implemented in any rural or urban area, quickly, accurately, and scalable to the size of the problem, adapting to the ways of working of each institution without disrupting any existing processes.

III. VigIA to Watch Public Contracts

The Veeduría Distrital is an entity attached to the Office of the Mayor of Bogotá. It seeks to defend citizens and public rights using preventive control and the promotion of active citizen participation to guarantee transparency to improve public management in the district and citizen coexistence.⁸³

In this context, VigIA is a tool developed by the Universidad del Rosario and the Development Bank of Latin America that emits an early warning system that, using AI tools, allows the identification of contracts signed by Bogotá that present a greater risk of corruption, irregularities, and inefficiencies and that serves as input for the Veeduría Distrital in its preventive control work.⁸⁴

VigIA brings together some of the characteristics that explain how the digitization of the state can contribute to improving its management. It's fed by open data, in this case, on public procurement and content in the *Sistema Electrónico para la Contratación Pública*, or SECOP. Therefore, to the extent that these types of tools are consolidated and provide more and better information, more reliability and accuracy in risk predictions will be achieved.

The software supports machine learning processes, and uses open-source tools which meet the highest standards in terms of implementation and replicability, facilitating its adoption within the Veeduría Distrital. The creation of the web platform to visualize the results allows users to see in a dynamic and user-friendly way which are the processes and contractors with unfavorable performance in terms of their state contracting processes. This makes it possible to identify which contracts present the greatest risk of inefficiencies and irregularities.⁸⁵ It's another way AI is helping achieve better government services.

Germany

Vera Demary and Henry Goecke, German Economic Institute

I. Thyssenkrupp Elevator's Predictive Maintenance Platform MAX

Hospitals have always been at the center of pandemics and other health crises. This was particularly the case during the COVID-19 pandemic. Policymakers relied on the healthcare system to provide them with the indicators they needed to implement safety measures or to relax them—such as incidence values and occupancy of intensive care beds.⁸⁶ At the same time, hospital personnel were at the forefront of caring for those infected with COVID-19, often contracting the disease themselves and risking their lives in the process.⁸⁷ Many hospitals were running at or beyond capacity for times on end.⁸⁸ That is why reliable medical, logistical, and technical equipment were of great importance for them during the pandemic.⁸⁹

One major part of the logistical infrastructure of hospitals worldwide are elevators built in hospital buildings. They are needed to transport patients, staff, and equipment between the different floors constantly. Their maintenance is therefore crucial. German elevator maker thyssenkrupp Elevators offers a cloud-based digital platform called MAX that collects data from 130,000 elevators and escalators worldwide to monitor performance and predict when maintenance is due.⁹⁰ The data are uploaded in the cloud in real time and analyzed using AI and machine learning algorithms. This service reduces elevator downtime by as much as 50 percent and provides a safer work environment for service engineers and hospital health workers alike.

During the pandemic, thyssenkrupp Elevator offered the MAX service free of charge to hospitals in the United States, Brazil, and France.⁹¹ The idea was that elevators as part of hospital buildings are in fact systemically relevant just like the hospitals themselves. By contributing to an efficient functioning of hospitals, the MAX predictive maintenance solution could play its part in dealing with the challenges of the pandemic based on data and data analysis. Depending on the country, the free digital service package was valid for six to twelve months.⁹²

II. Logivations' SARS-CoV-2 Occupational Health and Safety Standard

Over the course of the COVID-19 pandemic, different measures, rules, and actions have been introduced worldwide to fight the spread of the virus. Among these are vaccinations, testing, and social distancing. A vaccination against the virus seems to be the only way to move from a pandemic to an endemic situation. The development of vaccines took time—while being remarkably quick for drug development in general.⁹³ However, especially during the first year of the pandemic, the newly introduced vaccines were in short supply worldwide—and still are in less-developed countries.⁹⁴ The potential of testing for the virus depends, among other things, on the testing infrastructure of the respective country. Unlike testing and vaccinations, social distancing can be put into practice without any medical innovation or the need to build an infrastructure. Social distancing, or to be more precise, the success of social distancing, depends only on the behavior of people.

Thereby, social distancing applies not only to peoples' free time, but needs to be enforced in the workplace as well. To allow an effective method of enforcement in the workplace, the German

technology firm Logivations developed an AI-based tracking solution for workers.⁹⁵ The effectiveness of social distancing depends on how accurately people keep their distance from one another. The tracking solution controls the distances between workers: A camera system indicates objects and individuals and tracks their movements. If two individuals are coming too close to each other—meaning the distance between them is lower than a predefined value—a reaction in real time is given. This automatically generated real-time reaction can be flashing lights or an acoustic signal, for example. The individuals are then able to adapt their position in the workplace accordingly.

In addition, the system can also document the events for the health authorities in order to allow for more effective tracing of potentially infected people in the event of an infection in the workplace. If necessary, this documentation can be designed in a way that it protects workers' personal data. Using this AI-driven solution therefore helps to comply with regulations regarding the necessary distance between workers in firms and therefore contributes to fighting the spread of COVID-19.

III. app@work's Tool Sandman.MD and EU Horizon 2020 Project ENVISION

During surgery, a large amount of data accrues: Anesthesiologists, for example, are bound to document a patient's vital signs such as blood pressure and body temperature, the medication they administer and everything else they do before, during, or after a procedure.⁹⁶ Commonly, these notes were written down by hand. In Germany, they must be stored for 30 years. Because it was mostly on paper, the data was not available for further use, for instance for research or the treatment of other patients. app@work, a young Berlin company developing digital solutions for the health-care sector, changed this with Sandman.MD.⁹⁷ This tool automatically transfers data from the monitor and ventilator used during surgery and the recovery room to an iPad where the data is then stored. The anesthesiologist only adds very little data manually, such as the administration of medication.⁹⁸ This way, the data is available for further analysis. Frankfurt University Hospital (Universitätsklinikum Frankfurt) had collected data from 60,000 surgeries using the tool through 2020.

During the COVID-19 pandemic, the hospital successfully applied for a grant under the EU's Horizon 2020 project to study COVID-19 patients, and use the data collected to improve patient care. The project ENVISION uses Sandman.MD as a basis for a new tool (Sandman.ICU) that allows a 24-hour-surveillance of Intensive Care Unit COVID-19 patients.⁹⁹ All data from each such patient is collected on individual iPads and transferred to a central database. AI and machine learning programs then develop predictive models that allow patient-specific predictions on issues such as the further development of the disease in that patient, as well as the best possible therapy. That way, the understanding of the course of the disease and its treatment will be improved, while reducing burdens for health care professionals as well as healthcare costs.¹⁰⁰ Fourteen hospitals in 11 European countries have taken part in this project since it started in December 2020.¹⁰¹

India

CUTS International

I. Introduction

India imposed a 21-day national lockdown on March 24, 2020 to contain the transmission of the COVID-19 virus. The ability to rapidly test, and predict, at-risk patients was considered crucial to mitigating the spread of the pandemic. However, the same appeared challenging.

Furthermore, considering that COVID-19 was caused by a novel coronavirus, the medical fraternity was learning in real-time about the disease themselves, while treating patients. Consequently, as the pandemic raged and evolved in its initial period, frontline and healthcare workers including policymakers struggled with incomplete medical protocols with respect to information dissemination and answering queries raised by different stakeholders.

In addition to the above, the pandemic also triggered an infodemic, that is an enormous spread of misinformation and rumors on treatment measures, making dissemination of accurate information on COVID-19 diagnostics and other related information challenging and difficult.¹⁰²

The use of digital technology became imperative to overcome these challenges. Also, forging multi-disciplinary partnerships (government, healthcare labs/hospitals and workers, AI-driven algorithm developers, data driven application providers, etc.) became important for collectively tackling the challenges brought forth by the COVID-19 pandemic.¹⁰³

Accordingly, various partnerships were forged to facilitate COVID-19-inspired, AI-enabled innovations in India. Three examples are discussed below.

II. AI-enabled Technology Powered India's Response to the COVID-19 Pandemic

Background

To effectively handle the pandemic, the Indian Council of Medical Research (ICMR), India's apex body for the formulation, coordination, and promotion of biomedical research, needed the capability to use data for rapid detection and treatment.¹⁰⁴ In the absence of updated data on COVID-19 diagnostics and reporting, queries were increasingly made to the limited staff at ICMR from various testing and diagnostic agencies in the country, which soon became an unsustainable model.¹⁰⁵ Notably, many queries from different agencies were overlapping, creating duplicity (that is, different agencies were asking for similar information from ICMR).

Partnership

To streamline its response and strategy, ICMR partnered with IBM to launch Watson Assistant, an AI solution to respond automatically to COVID-19 queries raised by frontline and data entry workers from across the country.¹⁰⁶ The access to Watson Assistant was limited to authorized personnel involved in sample collection and testing in hospitals and diagnostics centers.¹⁰⁷

The technology is based on IBM Public Cloud using Software as a Service (SaaS) technology, such as Watson Assistant including Discovery and Language Translation. This virtual chat-bot automated and accelerated responses to queries on COVID-19 diagnostics and reporting with updated information. The queries were categorized under governance, logistics, data entry and sharing, and staff training and testing. Table 1 summarizes the players that developed the solution.

Table 1: Players in the Development of Watson Assistant for COVID-19 in India

Partner	Role/Strength
ICMR	ICMR spearheaded the development of the project.
IBM	IBM provided Watson Assistant, an AI assistant based on IBM Public Cloud upon which the chat-bot was built.

Use of Watson AI Technology and its Effectiveness in ICMR's COVID-19 Response

The Watson AI only required a few days to train query responses as compared to a virtual assistant that required manual training of many weeks. This helped ICMR to launch the solution in a few weeks. It allowed ICMR to focus on: developing and updating testing and treatment protocols and guidance for COVID-19, and strengthening its response time.¹⁰⁸

As the response and rules toward COVID-19 were constantly changing, Watson Assistant automatically fetched relevant and dynamic important information from multiple sources without requiring any change in the application of the technology. The chat-bot's ability to mine chat and email logs, categorize data, and create intent with training data streamlined ICMR's response to the pandemic while providing frontline and other health workers with the most up-to-date information to tackle the COVID-19 pandemic. This further helped the ICMR to expand testing facilities across remote locations with language barriers.¹⁰⁹

Takeaways

With the looming uncertainties and lack of updated, relevant, and important information during the COVID-19 pandemic, ICMR, with its limited staff, was restricted in providing a streamlined response to the increasing queries from frontline and healthcare workers across India. As a result, in partnership with IBM, ICMR implemented the AI-powered Watson Assistant that automated and accelerated the responses with the most updated and important information. This helped ICMR to develop and update testing and treatment protocols and expand facilitates across remote locations across the country, sustaining and streamlining its response to COVID-19 pandemic.

The ICMR-IBM initiative could be termed as a good-tech partnership facilitated by AI in times of the COCID-19 pandemic, which helped authorities to streamline its response when information was sparse and constantly evolving. With the greater availability of information now as compared to the early days of the pandemic, the AI-provided insights are expected to be far more accurate, which can quickly turnaround response times.

III. COVID-19: AI for Fighting Misinformation

Background

To fight the pandemic-induced infodemic, the Government of India's (GoI) Digital India Corporation (MyGov), in partnership with Haptik and WhatsApp, launched an AI enabled COVID-19 WhatsApp chat-bot helpdesk called the 'MyGov Corona Helpdesk' (Helpdesk) in March 2020.¹¹⁰ Created and launched within a span of less than five days, it was used to provide accurate information to citizens and was made available 24/7, in English, Hindi, and many regional languages.¹¹¹

The Helpdesk enjoyed massive success as over 30 million users in India utilized it for accessing accurate information and fact-checking.¹¹² Given the success which the chat-bot provided in curbing the spread of misinformation, MyGov also launched a web chat-bot MyGov Saathi in April, 2020 in partnership with technology giants Microsoft and Accenture.¹¹³ This was done in order to further enhance the capacity of fighting misinformation. Many users who didn't access the WhatsApp chat-bot utilized the MyGov Saathi feature.

Partnering with private sector entities, the GoI empowered its citizens by providing tools to fight misinformation and be updated on the COVID-19 guidelines provided by the government. Each partner brought with them different strengths, as has been given in Table 2 below.

Table 2: Players Involved in the Development of MyGov Corona Helpdesk

Tool	Partner	Role/ Strength
MyGov Corona Helpdesk	MyGov	MyGov anchored the development of the chat-bot.
	Haptik	Haptik's web Software Development Kit was used to pull data from multiple sources with adequate authorization.
	WhatsApp	WhatsApp has a very large user base in India. The platform was used to provide easy access to Indian citizens.
MyGov Saathi	MyGov	MyGov anchored the development of the chat-bot.
	Microsoft	Microsoft's Power Virtual Agent and the Microsoft Azure services were utilized.
	Accenture	Accenture worked on the development of the chat-bot.

Use of AI Technology and Its Impact and Effectiveness

The AI-enabled chat-bots were constantly trained to become better in providing their responses. The following summarizes some of the system's key features:

- Users leveraged the platform to seek help identifying and diagnosing COVID-19-related symptoms, to seek precautionary measures, to get details about the latest government guidelines on COVID-19 and lockdowns imposed, to provide authentic information against misinformation, and to provide fact-checking services.
- Lack of adequate training data in regional Indian languages caused a delay in releasing the service in regional languages.
- The MyGov Saathi platform was used to provide customized responses to farmers, migrants, senior citizens, frontline workers, and other specific citizen groups.¹¹⁴

Takeaways

AI enabled chat-bots have been deployed by many companies to give consumers timely responses. The same technique has been applied by the government in order to help citizens fight misinformation. This technique can be further deployed to help users gain access to information about other governance schemes and gain benefits from AI technology.

Further, AI afford an opportunity to utilize the massive data collected over many years. Utilizing it to benefit society in fighting misinformation is not only innovative, but also crucial at this juncture. Development along these lines can be implemented to fight misinformation of other kinds such as fake news, spam, and rumors among others.

IV. Risk Stratification Algorithms for COVID-19 Patients

Background

The use of digital technology became imperative for diagnostics and drug and vaccine discovery, with greater predictability, speed, and accuracy to contain the spread of the pandemic. Accordingly, a government-academia-industry partnership was formed between the Council of Scientific and Industrial Research (CSIR), Intel India, and the International Institute of Information Technology, Hyderabad (IIIT-H), with the objective of “helping in faster and cheaper COVID-19 testing, and coronavirus genome sequencing, to understand the epidemiology and AI-based risk stratification for patients with comorbidities.”¹¹⁵ Each participant brought with them different strengths, as summarized in Table 3.

Table 3: Key Players in the Development of Risk Stratification Algorithms for COVID-19 Patients

Partner	Role/ Strength
CSIR	Its constituent labs worked with various hospitals and diagnostic chains, carrying out comprehensive diagnostics.
Intel India	Developed an end-to-end system that consists of multiple applications, testing devices, data collection/aggregation gateways, and an AI model-hub platform.
IIIT-H	Developed risk stratification algorithms that can help in drug and vaccine discovery for long-term preparedness to combat the epidemic.

Use of AI Technology

The partnership explored three possible outcomes, namely: 1) patient is admitted in hospital but without much complication; 2) patient had to be given supplemental oxygen or put on ventilator; and 3) patient does not survive. Five crucial variables were used for risk prediction: age, neutrophils (type of white blood cells), lymphocytes (type of immune cells), LDH (an enzyme), and hs-CRP (C reactive protein). Based on these, using AI and machine learning, the participants found/achieved:

- Younger people recovered faster, thereby helping in categorizing risks and prioritizing scarce healthcare facilities; and
- Risks could be predicted around 12 days before the expected outcome, thereby helping in accelerated decision-making by healthcare professionals for appropriate treatment;¹¹⁶
- Evidence was found for linking mortality with use of steroids, which was in line with the early treatment protocols set by the government.¹¹⁷

Table 4 summarizes important development milestones in the project.

Table 4: Important Milestones in Developing Risk Stratification Algorithms for COVID-19 Patients

March, 2020	Partnership was conceptualized by Intel India, which approached IIIT-H, and CISR.
May, 2020	Partnership was forged, and work began on foreign datasets (from Wuhan, China, and the United States). Mortality prediction results were 96 percent accurate. Early results showed that mortality and the number of people being affected was less than initially predicted.
August, 2020	Work began on Indian datasets in Delhi and Hyderabad. Researchers also tried to source data from Kolkata and Rajasthan. Mortality prediction results were 58 percent accurate. Initial results showed that mortality rate in India was lesser than western countries.
May, 2021	Mortality Prediction Model developed in theory, and paper titled “Machine Learning Based Clinical Decision Support System for Early Covid-19 Mortality Prediction” was published. However, the same has still not been used practically.

Challenges and Shortcomings

The team faced various challenges and roadblocks, causing various shortcomings in the AI model:

- Absence of access to adequate electronic health records, due to risks of compromising privacy (i.e., model is based on only 544 Indian patients’ data);
- Inadequate access to anonymized healthcare data; and
- Model based on first wave data, which needs to be updated for the second wave (outdated data).

Due to the above, despite the AI model having great potential in early detection of mortality risks and risk stratification, it is yet to be used and deployed in clinical practice.

V. Conclusion

Emerging good-tech-AI driven innovative partnerships between the public and private sector can be an effective tool to streamline responses to societal challenges, such as the COVID-19 pandemic. As shown in the examples above, the Public-Private Partnership (PPP) model has been effectively utilized in combating the pandemic in India. Such partnerships not only lead to better innovations but also provide citizens with better access to services. However, in the healthcare sector, the same is dependent upon access to good quality and a good quantity of healthcare data, which is currently scarcely available. Risks to privacy and lack of appropriate regulatory frameworks are reasons explaining this.

India currently lacks a dedicated data protection law, as the Personal Data Protection Bill 2019 is still pending with the Joint Parliamentary Committee and is yet to see the light of day. Progress is also stalled on the draft Digital Information Security in Healthcare Act 2017.¹¹⁸ However, efforts are

ongoing to come up with patchy solutions for governing health data, through the Health Data Management Policy, under the National Digital Health Mission.¹¹⁹

Passing these laws has become crucial for ensuring AI-driven innovation for healthcare, and achieving the government's ambition of rolling-out a Universal Health Interface, which will serve as a digital technology network for connecting different stakeholders of the National Digital Health Ecosystem.¹²⁰

Italy

Giacomo Bandini, Competere and Stefano da Empoli and Maria Rosaria Della Porta, I-Com

I. The AlforCOVID Imaging Archive

Radiological imaging has played an increasingly key role in the diagnosis of COVID-19 patients and in determining therapeutic options, patient care management, and new research directions.¹²¹ For this reason, CDI Centro Diagnostico Italiano, an important health institute in Milan and accredited by the Joint Commission International, with Bracco Imaging S.p.A. (Milan), promoted the AlforCOVID project: a multi-center, observational, retrospective, non-profit study to develop AI-based algorithms capable of analyzing radiological and clinical data and predicting the clinical outcomes likely for COVID-19 patients.¹²² Specifically, it is a model that analyses chest X-ray examinations performed at hospital admission in suspected COVID-19 patients and contextually associated with important clinical information about the patient. All the images are archived in a specific dataset. Moreover, images and clinical data are analyzed using three machine learning methods and radiomics—a support vector machine (SVM), logistic regression (LR), and decision trees (DT). Models were validated with 10-fold and center-wise cross-validation and showed 74, 75, and 65 percent and 73, 75, and 60 percent accuracy, respectively, with 10-fold and center-wise cross validation.¹²³

Therefore, AlforCOVID may be able to identify elements invisible to the human eye to be considered as indicators of serious prognosis such as the risk of undergoing a worsening of the lung condition, and allows doctors to assess in advance the possible need for any intensive therapy.

In addition to the CDI, promoter of the project, and Bracco Imaging S.p.A, important hospital excellences and public and private research institutes participated in the project, such as the IRCCS Ca 'Granda Ospedale Maggiore Policlinico Foundation (Milan), the IRCCS Policlinico San Matteo Foundation (Pavia), the Hospital University Careggi (Florence), ASST Santi Paolo e Carlo (Milan), ASST Fatebenefratelli-Sacco (Milan), ASST San Gerardo Hospital (Monza), Campus Bio-Medico (Rome), and Italian Institute of Technology (Genoa). More specifically, data analysis and the development of AI algorithms were carried out by the Italian Institute of Technology (IIT), based in Genoa, and Campus Bio-medico, based in Rome. Moreover, the project was also powered by Amazon Web Services (AWS), by integrating a range of AWS technologies, including Amazon SageMaker machine learning and AI, a fully managed service for creating, training, and deploying machine learning models, as well as data and analytics services.¹²⁴

The AlforCOVID Imaging Archive platform is part of the list of radiological imaging databases that EIBIR (European Institute for Biomedical Imaging Research) has compiled and published in order to encourage the study and further development of AI solutions applied to COVID-19 diagnosis. The platform was also presented at the last European Radiology Congress, ECR 2021, in Vienna.

II. Almagest Iride Call: Natural Language Processing and AI for the Public and Private Sector

The COVID-19 pandemic has deeply affected public and private organizations' service delivery worldwide. Governments implemented social distancing and isolation policies to reduce the risk of

transmission and the spread of COVID-19, while the research, development, and testing of antiviral treatments and vaccines were ongoing. As a consequence of these isolation policies, the need to manage timely, reliable, and precise information for citizens and consumers has dramatically risen.¹²⁵

In addition to requests for intervention or even simple information, outbound campaigns for prevention and education have been pivotal in the new operational scenarios. The main issue here concerns the congestion of the telephone lines of hospitals, local authorities, and municipal administrations.¹²⁶ This is also a problem encountered by companies that have increased their e-commerce strategies due to the physical lockdowns, and which have necessarily reshaped their approach to front-end activities.

Almawave's Iride platform based on NLP, Automatic Speech Recognition (ASR) and Interactive Voice Response (IVR)—using advanced AI technologies—has been implemented during the pandemic to help public organizations and private businesses better manage the substantial flows of information and key data analysis.¹²⁷ NLP is the branch of machine learning focused on obtaining information representations by analyzing text and speech data.¹²⁸ Recent achievements in NLP include automatic speech recognition, information extraction, and image captioning. These recent achievements are being applied to develop voice assistants to transcribe customer or patient information into databases.

Almawave's Iride Call tool was launched in 2020 and helped contact center operators with single multi-source information and cross-channel tools to manage user requests with effectiveness. According to Almawave, management times have been reduced by 20 percent and the quality of assistance improved with an increase in the number of requests resolved on first contact by 10 percent.¹²⁹ Chatbots and IVR natural languages have improved end-to-end management of requests by 30 percent automating and accelerating the responses, therefore planning callbacks more effectively (+ 80 percent) on the channel and at the preferred time thanks to the AI-based features.¹³⁰

As the pandemic rapidly spread in Italy in 2020, Almawave's Iride platform was adopted by local public-health authorities to monitor COVID-19 cases by using NLP to process incoming emails, calls, and chat messages from their patient help lines for a range of COVID-19 related symptoms.¹³¹ The project, RicovAi-19, involved local public health authorities and hospitals also supporting the real time analysis of multiple clinical parameters of patients with COVID-19 symptoms (body temperature, blood pressure, oxygen saturation, respiratory rate, etc.), to elaborate the so-called Clinical Stability Indicator and to transmit the results promptly to clinicians.¹³²

III. Vera: Conversational AI Assistant to Fight Misinformation During the COVID-19 Emergency

During the pandemic, society has also been experiencing an infodemic, an overabundance of information that is often false, misleading, or unreliable. False information runs the gamut, from discrediting the threat of COVID-19 to conspiracy theories that vaccines could alter human DNA. However, public trust in science and evidence is essential to overcoming the COVID-19 challenge. Therefore, finding solutions for limiting the damage and spread of false information is just as vital in order to overcome the pandemic.¹³³

For this purpose, Pagella Politica, Facta, IRCCS San Raffaele Hospital, and Eurecom have developed "Vera," an AI project that, thanks to an interactive chat conversation, helps people recognize fake news and better find their way around the huge amount of information regarding COVID-19.¹³⁴ In Vera's "Checking hoaxes and data in the world" section, for example, false news circulating on WhatsApp or updated statistics on the epidemic can be verified, while the "Questions About COVID-19" section is dedicated to clarifying doubts on issues of a medical and scientific nature on the ongoing epidemic.

Pagella Politica and Facta have dealt with fact-checking content on COVID-19, while the IRCCS San Raffaele Hospital has coped with the part regarding scientific questions and answers. Eurecom, on the other hand, has contributed with the integration of CoronaCheck, a chatbot that allows for comparing different countries worldwide on the pandemic numbers, into Vera.

Vera was developed by Indigo, a startup specialized in the design and implementation of virtual assistants, language technologies, and conversational experiences and illustrated by the creative studio Illo. It's funded thanks to the Coronavirus fact-checking grants, promoted by the International Fact-checking Network.

Mexico

Carolina Agurto, Fundación Idea

I. Context

Before the pandemic struck, Mexico's digital landscape exhibited an important gap: although 76.6 percent of the urban population regularly accessed the Internet, only 47.7 percent of the rural population did so, and nationally, only 44.3 percent owned computers.¹³⁵ In regards to AI, there was notable underdevelopment and little understanding of the implications and benefits of this technology. According to an MIT and Everis AI in Latin America report, out of 55 percent of the Mexican companies that the report groups, only 1 to 10 percent of them were already investing in AI in 2020, about 47 percent had an ongoing AI project, and 22 percent did not have the capacity to do so.¹³⁶ Additionally, most Mexican companies were not familiar with important concepts in the field, such as machine learning and big data. This lack of knowledge, coupled with poor technological infrastructure and financial viability, resulted in a static AI field in the country.¹³⁷

Prior to the pandemic, Mexico had a governmental office—part of the Executive branch—that dealt with technological development and AI, called the Under Secretary of Communications and Technological Development. Unfortunately, in 2020, the disappearance of this governmental office was announced, which was then replaced by the Coordination for the National Digital Strategy.¹³⁸ This is no longer a governmental institution, but rather an element of the Mexican Development Plan, a document where the federal administration sets the core objectives it has chosen to pursue. In the case of the current Mexican federal government, the Mexican Development Plan has been divided into three axes: political, social, and economic. Technology falls under the economic category, and is left in the hands of the CONACYT Innovation Plan, and the aforementioned Coordination for the National Digital Strategy.¹³⁹

The CONACYT (Science and Technology National Council) has promised to develop a National Computer Science Ecosystem, where knowledge generation will be key and will serve as a base for the development of complex systems, data science, and AI.¹⁴⁰ On the other hand, the Coordination for the National Digital Strategy has focused on the previously mentioned digital gap and on finding widespread solutions to accessibility problems nationwide. During the pandemic, this proved useful when schools were forced to shut down and public schools replaced in-person learning with television learning. In this sense, children could tune into public TV channels and learn remotely.¹⁴¹

II. iRx: Radiografías por México (Radiography for Mexico)

During the pandemic, it became evident that in-person contact would have to be reduced as much as possible. Hospital and medical staff had no choice but to risk infection; however, technological efforts such as iRx Mexico offer innovative resources that facilitate effective implementation of safety measures.

iRx is a telemedicine platform that offers accessible and speedy medical attention in COVID-19 cases. The program requires patients to upload radiography scans which are then analyzed by an AI algorithm, and a preliminary diagnosis is made in less than 90 minutes. The scans and conclusions

made by the AI are then passed on to a group of certified doctors, who make appropriate changes, or approve of the diagnosis. This data is handed over to specific affiliated hospitals, and a final diagnosis and treatment plan are agreed upon.¹⁴²

According to founding partner, Karlo Rodríguez, iRx was born from a preoccupation with the overcrowding of the Mexican healthcare system, and is currently present in two public hospitals in the states of Oaxaca and Puebla, and over 10,000 people have been benefited by the platform. The endeavor is funded by non-governmental organizations (NGOs) and civil associations, and local governments have offered openness and cooperation to the efforts.

In the future, Karlo and his partners hope to extend the platform's uses to other parts of the human body in order for public and private organizations to have widespread access to the information they provide. In this sense, the group is currently in the process of offering breast cancer scans to hospitals in Oaxaca.¹⁴³

III. Mexican Universities Embrace AI Innovation

Throughout history, education institutions have been crucial to the understanding of Mexican challenges and their solutions. From social issues, to political and scientific affairs, students and university collaborators have shaped modern Mexican culture.¹⁴⁴ During the ongoing COVID-19 pandemic, these institutions have been key actors in the adoption of AI, as well as innovations in the field: specifically in monitoring, prediction, and treatment of the coronavirus.

In March 2020, a group of alumni from the University of Monterrey developed an accessible, low-cost respirator.¹⁴⁵ Inspired by previous investigations led by MIT, and aided by professor Raúl Quintero, Andrés González Ramos, Sergio Caballero Lozano, Omar Beltrán Márquez, and Víctor Cárdenas Domene created respirators that were adjusted to the pandemic, available resources, and national accessibility. Made with common store-bought objects, and an ambu bag, their creation is priced at around \$139.17, while a traditional respirator would cost between \$20,000 and \$30,000. With low respirator availability, and soaring poverty levels, this handmade device is of great aid in the battle against COVID-19.¹⁴⁶

Similarly, in April of last year, Tecnológico de Monterrey's health department (TecSalud), began the use of robot technology in COVID-19 treatment. A-NÍMO, the institute's innovative robot, allows doctors to treat patients remotely via computer-controlled commands. A-NÍMO's screen, microphones, movement detectors, and wheels make for personalized attention, safe consultations, and better use of health supplies.¹⁴⁷

La Salle University has also been actively working on the development of an AI-based platform that predicts the number of infected people, deaths, hospitalizations, and possible date of peak infection rates. In order to predict this data, the program uses five different models that are first fed historical statistics. Finally, an average amount of infection, death, and hospitalization is calculated, as well as each figure's margin of error. Projects like these aid in the widespread provision and adoption of information. This then allows families and individuals to shape their behavior in accordance with public health safety measures.¹⁴⁸

IV. Post-Pandemic Reactivation

Mexico's entrepreneurial ecosystem is one of the most prepared in the world for the utilization of AI. Despite the lack of knowledge regarding this technology, around 58 percent of Mexican CEOs believe that it could benefit and transform their companies. Additionally, the adoption of associated technologies could result in a sustained 1 percent GDP growth during the next decade. AI could also be of great aid in the field of social good, especially during and after the COVID-19 pandemic. In order to achieve this, however, a few recommendations should be taken into consideration: widespread knowledge about the topic, the creation of laws and legislation that deal with responsibilities and regulations, and reduction of inequality and informal work. The aforementioned suggestions would result in an appropriate infrastructure that would allow for the safe use of AI.¹⁴⁹

Some examples of AI strategies to keep an eye on, and that will likely have great national impact upon their implementation, are: *Habilidades para la Prosperidad* (Skills for Prosperity Mexico or SFPMx), *Capacitación Digital de Obreros y Migrantes* (Digital Training for Workers and Migrants), and *Escuelas Seguras en Línea* (Safe Online Schools). The first is a program by the British Embassy in Mexico that looks to prepare students for the transition from school to work environments by offering to teach useful abilities in the current job market. This is to be done by means of collaborative models between public and private sectors that will allow students to access better job opportunities.¹⁵⁰

The second is a project developed by an investigative team from UNAM (Universidad Nacional Autónoma de México) and the University of West Virginia. It consists of a bots-based system that aids in training migrants and workers in digital abilities in order for them to be able to apply for higher-ranked jobs. Finally, *Escuelas Seguras en Línea* is an initiative led by the Inter-American Development Bank and the *Laboratorio de Resiliencia Eón* by C Minds (a Mexican impact innovation agency) that aims to facilitate the transition from in-person learning to online learning by offering digital tools that protect children's data. This is to be done by means of a guide for teachers and staff, as well as issuing public policy recommendations to education ministries in Latin America.¹⁵¹

Nigeria

Grace Sly, Information Technology and Innovation Foundation

I. Flutterwave Assists SMEs

Following the relaxation of restrictions on financial technologies by Nigeria's Central Bank in 2018, the largest economy in Africa has been at the forefront of payment digitalization.¹⁵² This growth was enhanced by the COVID-19 stay at home orders as mobile money transactions increased by 14.5 percent between February and March 2020, the months when the virus was first reported in the country.¹⁵³ Despite in-person bank visits being permitted again, social distancing measures made the process time-consuming, as the country continued to shift toward electronic payments.¹⁵⁴

Mobile payment companies, such as the Lagos- and San-Francisco-based startup Flutterwave, saw both financial growth and service expansion throughout the pandemic. Launched in 2016, Flutterwave carries out digital payment services in 150 currencies across multiple payment modes including local and international cards, mobile wallets, and bank transfers.¹⁵⁵ With its second-round investments arriving shortly before Nigeria's COVID-19 outbreak, Flutterwave secured over \$225 million in funding by March 2021. Founder Olugbenga Agboola attributed the company's growth of over 100 percent in revenue this past year to its "COVID beneficiary sectors" such as streaming, gaming, and e-commerce.

As the pandemic disrupted many business operations, Flutterwave saw an opportunity to help vendors, particularly SMEs, by creating an online Flutterwave Store to increase ease of access for merchants. The program uses AI-based machine learning to foster e-commerce and has gone live across 15 countries in Africa; by the spring of 2021, it had helped over 20,000 merchants sell their products online.¹⁵⁶ As a one-stop-shop, SME owners can upload products, access analytics, and pay suppliers on the platform while being charged only a small transaction fee.¹⁵⁷ Flutterwave Store is uniquely focused on helping small businesses since, according to Agboola, "The goal is not to become like eBay, that's advocating for everybody. We're just giving small merchants the infrastructure to create an online store at zero cost right from scratch."¹⁵⁸ As the International Finance Corporation estimates, SMEs account for 90 percent of Sub-Saharan Africa's business, Flutterwave expects its new service to be helpful amid the pandemic and beyond.¹⁵⁹

II. Government Initiatives Embrace AI

The government of Nigeria has embraced the benefits of AI and taken action to support advancing these technologies. In 2020, a new Centre for Artificial Intelligence and Robotics (CFAIR) was inaugurated to promote emerging technologies and prepare for a 'fourth industrial revolution.'¹⁶⁰ According to Dr. Isa Pantami, Minister of Communications and Digital Economy, the center aligns with the National Digital Economy Policy and Strategy as AI plays a role in refining the digital economy, shaping future society, and ushering in new ways of living, learning, travelling and working.¹⁶¹ Pantami cited a study by PwC to emphasize the impact AI will have during COVID-19 and beyond on a variety of sectors as well, as the economy as a whole, and stressed that Nigeria

must not fall behind in taking advantage of the projected \$190 billion in business value AI will create.¹⁶²

Already, the government has planned several initiatives that incorporate AI and machine learning to enhance operations, such as the Ministry of Communications and Digital Economy's new plan for countering growing insecurities in the country by deploying AI and robotics.¹⁶³ The government has also partnered with companies such as Microsoft to make the most of emerging technologies. In May 2021, a joint announcement launched multiple projects aimed at strengthening the new economy, specifically by improving connectivity, skilling, and digital transformation.¹⁶⁴ Several of these activities will utilize AI.

- In line with the aforementioned plan of using AI to address crime, and through coordination with the Economic and Financial Crimes Commission, Microsoft will apply AI and machine learning to identify potential financial risks and reduce corruption.¹⁶⁵
- With an aim to preserve Nigeria's cultural heritage, the National Institute of Cultural Orientation will enlist Microsoft and some of its AI solutions to support the safeguarding and revival of the country's major indigenous languages: the Hausa, Yoruba, and Igbo.¹⁶⁶

There are other ways these innovations are being used to close the gap between the government and the public. Several organizations are working to make legislation more accessible for the general population. Data Duality's NASS-AI project uses machine learning and natural language processing to curate and classify parliamentary bills from the National Assembly to provide accurate metadata with which to compare and analyze future proposals.¹⁶⁷ Another initiative hopes to address the evolving profile of Nigeria's poor to account for those pushed into poverty by the COVID-19 crisis. The Rapid Response Register for the COVID-19 Transfer Project relies on geospatial data and machine learning to generate poverty maps that show where specific communities in need reside.¹⁶⁸ This technology can be used beyond the pandemic response, as such algorithms learn predictive features for signaling poverty in order to better target social protection programs.¹⁶⁹

III. Wellvis Creates COVID-19 Triage Tool

As the COVID-19 pandemic underscored the importance of investments in health and health technology, telemedicine platforms such as Wellvis Health have continuously innovated to meet community needs. In 2020, Wellvis introduced a free COVID-19 Triage app to help users anonymously assess their risk of infection through a series of targeted questions ranging from an individual's exposure to experienced symptoms.¹⁷⁰ The tool utilizes AI and machine learning to provide remote medical advice or redirects users to a hospital, thereby reducing the number of unnecessary calls to local disease control hotlines.¹⁷¹ Designed employing the official definitions designated by the Nigeria Centre for Disease Control (NCDC), the app can categorize users into low-, medium-, and high-risk categories based on their responses to clinical and epidemiological questions.¹⁷²

The tool was launched in March 2020 and made available in five languages common in Nigeria: English, French, Hausa, Yoruba, and Igbo.¹⁷³ An Unstructured Supplementary Service Data version was introduced in July 2020 for people without access to smartphones or the Internet, thereby improving access to over 180 million mobile users.¹⁷⁴ By early 2021, the tool had been utilized over

400,000 times and expanded its geographic reach, with the majority of users coming from Nigeria (70 percent), Ghana, the United States, the United Kingdom, Canada, and South Africa.¹⁷⁵ Additionally, the app has been officially adopted by the NCDC and integrated as part of the outpatient management protocol for University College Hospital, Ibadan, the leading public hospital in Nigeria.¹⁷⁶ As its use grows, some have credited Wellvis' triaging with assisting the reduction of community transmission across Nigeria by alerting users to high-risk COVID-19 exposure.¹⁷⁷

Beyond COVID-19, Wellvis seeks to improve its platform and develop features that help people access medical information, advice, and workers on demand. The company digitally connects doctors to those whose geographic or financing burdens prevent hospital access, an issue that has been exacerbated by the pandemic.¹⁷⁸ According to Wellvis CEO Wale Adeosun, this problem has made domestic and foreign investors aware of the potential for his company to effectively assist a large number of people as "nobody wants to miss out," especially when "looking at a post-Covid scenario."¹⁷⁹ Looking toward the future, Wellvis executives aim to impact and aggregate specific demands in the health sector, such as partnering with hospitals to offer discounts on surgical operations or creating support groups for people who share diseases and common ailments.¹⁸⁰ As stated by co-founder Moshood Abdulateef, "a scaled Wellvis is the go-to platform for solutions to all health issues."¹⁸¹

Philippines

Queen Cel A. Oren, Francis Mark A. Quimba, and Ramonette B. Serafica, Philippine Institute for Development Studies

I. AI Strategy Roadmap

The Department of Trade and Industry (DTI) launched the Artificial Intelligence (AI) Strategy Roadmap in 2021 to prepare and guide the development of AI in the country.¹⁸² It identifies four important dimensions for AI readiness: 1) Digitization and infrastructure; 2) Research and development; 3) workforce development; and 4) regulation. Seven measurable strategies and 42 strategic tasks were also enumerated to track the progress and measure the success of the AI economy. The roadmap also aims to create the National Center for AI Research (NCAIR), composed of scientists and research engineers. Its roles include assisting micro, small, and medium enterprises (MSMEs) in using computational tools and AI technology to improve their businesses.¹⁸³

II. Support for Research Activities of Startups

Research funding is available for AI-powered projects in the health sector through the Startup Research Grant Program for Filipino startups.¹⁸⁴ Created by the DOST-PCHRD (Department of Science and Technology–Philippine Council for Health Research and Development) in line with the Innovative Startup Act, the first batch of grantees includes the following three startups:

- SEEYOUDOC Corp., an online medical appointment system that provides medical notes, e-prescription, and a digital payment system. The grant shall be used to develop and improve an interactive analytics platform to enhance medical facilities' adoption of telemedicine.
- Medhyve, an online procurement platform that connects health administrators and medical suppliers. The grant will help Medhyve develop AI-powered forecasting and product recommendation engine for more simplified and efficient procurements in hospitals, particularly rural areas.
- Pivotal Peak Digital Health Solutions, Inc., whose services include a user-friendly web-based app containing electronic medical records (EMR) for healthcare providers, an electronic referral system to connect specialized clinical services, and telementoring for the career development of health professionals and workers.¹⁸⁵ The grant shall be used to create a two-way electronic referral system, making government-to-government, private-to-private, and private-to-government referral more efficient.¹⁸⁶

The DOST-PCIEERD (Department of Science and Technology—DOST Philippine Council for Industry, Energy and Emerging Technology Research and Development) allocated PHP 60 million (\$2 billion) research grants to help combat the effects of COVID-19. Priority areas include work from home tools, workplace ergonomics, safe mobility and transport, response and coping up with the new normal (e.g., digital services, virtual learning), testing and calibration of locally developed medical devices, geospatial and ICT solutions, new devices and products, protective coatings for surfaces and PPEs, detection and disinfection technologies, and emergency food.¹⁸⁷

III. Using AI for Health

The Department of Health (DOH) also used AI in response to the COVID-19 crisis by creating KIRA KontraCOVID Bot (chatbot) in collaboration with AI4GOV and AIAH.AI.¹⁸⁸ It is a web-based digital triage platform available in PH web app, Facebook, and Viber where anyone can efficiently access updated health information and guidelines. It provides self-checks to measure risks for COVID-19, vaccine information, telemedicine hotlines, and other COVID-19 related information.¹⁸⁹

The DOH partnered with Senti AI along with Google in 2020 to upgrade its efforts in information dissemination. Senti AI started as a research project at De La Salle University, initially intended to build an algorithm that would translate Filipino to English language and vice versa. They were able to get support from the DOST-PCIEERD. From being a research project, it later became a startup AI company in the Philippines. One of its projects included a partnership with the DOH to develop a centralized communications platform containing updated and relevant information related to the COVID-19 pandemic. This can be useful for the DOH partners, health workers, and the public. Considering that health information and guidelines rapidly change, the system was designed so that the DOH can easily add, modify, and delete stored information. Powered by AI, the process includes the DOH providing the system with FAQs, policy guidelines, and other relevant and updated information for the public and health workers to access. Senti AI analyzes these data and matches questions with responses using Google sheets. The mapped data is fed to the knowledge base model. Different channels like chatbots can also be easily integrated with the system. It uses AI tools such as natural language understanding, intent detection, and entity detection to respond to users' queries. The system was able to recognize questions from users, whether in English or Filipino, translate them into structured data, and respond with relevant and timely information from DOH sources.¹⁹⁰

This initiative aims to ensure that both rural and urban areas are in sync with regard to receiving health information and policies. This tool is expected to eliminate misinformation and miscommunication that are prevalent on the Internet. As a result, the tool has enabled the DOH to disseminate information more seamlessly and efficiently. It can also flexibly handle new topics created by users, and it is expandable to allow integration with different platforms.¹⁹¹

IV. AI-powered Thermal Scanning Drones

While the government built a framework for AI innovation, supported innovative startups, and upgraded systems to cope with the pandemic, academic institutions also produced practical technologies relevant to mitigating the effects of the COVID-19 pandemic. Alumni and students from the Far Eastern University established DWARM Technologies, which initially developed an AI-powered drone equipped with a thermal camera to identify potential survivors during disaster relief operations. With the onset of the COVID-19 pandemic, DAWRM upgraded its technology that uses AI to identify individuals and their corresponding temperature by using a video camera that detects a person and a thermal scanner to measure their corresponding temperature. This will reduce physical contact while identifying persons with high body temperatures.¹⁹² The DOST provided funding to develop six units of AI-powered thermal scanner drones. The thermal scanner drone alerts the operator with a sound and sends a photo of a person detected with a high temperature. It can transmit real-time data, be equipped with GPS, and communicate with the base station within a two-kilometer range.¹⁹³

V. Online Community Monitoring

Another private initiative called Project Greengrass developed an online community map for real-time monitoring of street activities. The AI-powered system helps identify areas with a high concentration of people and curfew violators. Using the system, local government units (LGUs) can more efficiently implement quarantine protocols. It also helps maintain and enhance security measures in local communities, despite limited human resources. LGUs and businesses are encouraged to contribute their CCTV networks.¹⁹⁴ One of the project's CCTV contributors is Barangay San Antonio in Pasig City. It was equipped with 73 CCTVs with AI-enabled technology to ensure that social distancing is observed. The personnel monitoring the system can easily detect areas with a high concentration of people through smart CCTVs that display the number of people in certain areas. It also uses color codes for more efficient monitoring: green for areas with at most one person detected, orange for areas with 4 to 10 people detected, and red for areas with 11 or more people detected. They can then call and deploy security personnel to red-coded areas to enforce social distancing.¹⁹⁵

VI. AI and Business Process Outsourcing (BPO)

The results of the Asia Pacific AI readiness Index show that the Philippines ranked sixth out of seven countries within ASEAN due to AI development remaining fragmented and uneven, but a report by the McKinsey Global Institute on the uses and effects of AI in Southeast Asia highlights that the Philippines is currently at the average level of adoption of AI in key technology sectors such as telecommunications, manufacturing, financial services, consumer package goods, and transportation and logistics.¹⁹⁶

According to an IDC report, IBM, Dell Technologies, ODM Direct, HP Enterprise, and Accenture have the largest share to AI revenue during the period 2016 to 2018. Because some of these companies are already present in the Philippines (IBM, Dell Technologies and Accenture), there is potential for the country to be an AI and big data analytics hub if these Philippines-based companies expand their business activities in the country to include AI. The DTI, in partnership with the Asian Institute of Management, launched the AI roadmap for the Philippines, which recognizes the potential of the country to upgrade from a BPO services hub to big data processing not only because of the existence of a strong BPO industry but also because of the increasing support from educational institutions offering programs on data science, such as the Asian Institute of Management.¹⁹⁷

United Kingdom

Philip Stevens, Geneva Network

I. Chest Imaging Database Helps Focus COVID-19 Patient Care

As anyone who's swapped an analogue camera for a new mobile phone will appreciate, having an organized, dated, and catalogued set of images at your fingertips can be a powerful thing.

What if a similar order—and speed—were brought to bear to allow sharing of images critical to the effective treatment of COVID-19 patients for medical professionals across the National Health System (NHS)?

It is now a reality, in the shape of the National COVID-19 chest imaging database (NCCID), an AI-enabled imaging library that is driving faster patient assessment in emergency rooms and improving the consistency of COVID-19 treatment.

The NCCID was made possible thanks to close collaboration between the British Society of Thoracic Imaging (BSTI) and Royal Surrey County Hospital NHS Foundation Trust. The project evolved from early work by the BSTI to inform radiologists around the country about the chest imaging characteristics commonly seen in COVID-19 patients.

Clarity From Complexity

The NCCID was developed to help clinical researchers in medical imaging and AI fields learn as much as possible about COVID-19 by analyzing a comprehensive sampling of acute chest imaging.

To be effective, the database required data on a large-enough scale to capture local and regional differences in disease characteristics. A comprehensive data set was compiled thanks to the contribution of 90 hospitals nationwide, using a pre-existing NHS infrastructure to collate the imaging data.

Speaking about the NCCID, Dr. Joe Jacobs, a clinical radiologist, said: “NCCID imaging data is being linked to national repositories of clinical data in COVID-19 patients and will be invaluable for the national programs studying the long-term effects of COVID-19 infection.”

As Jacobs continued, “In the UK, the NHS uniquely has the resources to make it possible to pull together imaging data, link it to clinical, epidemiological, and genomic data and gain inferences about diseases both common and rare, acute, and slowly progressive, that affect one organ or the whole body, across the entire population.”¹⁹⁸

The database is available to researchers, clinicians, technology companies, and others working to investigate the disease and develop solutions that can support the COVID-19 patient care pathway.

II. The AI-led Vision Taking Smarter Eyesight Monitoring ‘Home’

Being encouraged to play computer games to help look after your eyesight may seem like an elaborate hoax.

But a new dynamic eye monitoring system developed by two eye doctors in a busy hospital clinic in Cardiff works in precisely that way—to make clinical-level remote testing possible in patients' homes.

The OKKO Health app—launched in May 2020—is the brainchild of ophthalmologist Dr. Luke Anderson and optometrist and vision science researcher Stephanie Campbell. They were moved by the growing waiting lists at their hospital clinic, knowing that half of all visitors were there for routine eye disease monitoring.

Dynamic measurement, simple access

Behind OKKO Health's simple games format lies the serious AI element in the form of deep vision science. For patients, it's simple. They access the app's games on a smartphone or tablet—using existing sensors in the devices—linked to a secure cloud-based server holding encrypted data and a clinical dashboard.

On top of traditional clinical insight and games technology, the apps use predictive algorithms fueled by a far wider range of data from OKKO's dynamic new vision tests. They are part of a more dynamic picture of vision measurement, beyond visual acuity to also include low contrasts distortion metrics and color vision.

The information fuels these next-generation algorithms to anticipate eye deterioration ahead of time.

Sustainable Eye Care

Over two million people are living with significant sight loss in the United Kingdom, according to the Royal National Institute of Blind People (RNIB). It says the figure could double to over four million by 2050, but also that early detection and treatment could cut this figure by more than half.

OKKO's approach goes beyond software development to improving the whole eye care system, from service providers to patients, making it more sustainable and reducing hospital visits for eye problems.

For patients, reliable monitoring at home allows them to rapidly access specialist eye care when they need it most and reassures them to stay at home when their condition is stable. It improves their vision, wellbeing, and, in many cases, saves their sight.

For service providers, home monitoring between appointments drives earlier identification of problems and prompt treatment. Local systems can customize eye care and operate more dynamic appointment schedules.

OKKO is also looking at ways to partner with forward-thinking organizations to identify novel digital biomarkers of eye disease. Its technology has applications across clinical practice, scientific research, and in the research and development of new drugs and devices.

III. Navenio—Intelligent Software for Indoor Locations

Space has always been the final frontier and thanks to AI-powered technology, an Oxford-based company had made a giant stride for the safe, efficient use of indoor space.

COVID-19 has brought unprecedented demand—and pressure—on the NHS. It's also made the issue of the safe, efficient deployment of people in hospitals, clinics, schools and offices paramount.

Described by former NHS England deputy CCIO Dr. Harpreet Sood as, “like the Uber for healthcare staff,” Navenio has taken computer science begun at Oxford University and turned it into a cutting-edge indoor location tracking technology to transform the way staff move around hospitals, schools and more.

Navenio’s smart solution is already having a dramatic effect on the efficiency in UK hospitals, leading to better care and patient outcomes. Its potential goes way beyond hospitals—Navenio can be applied to any building, in any sector, anywhere.

Accurate Tracking, Optimum Logistics

What makes Navenio different? Navenio is an innovative fusion of five computer sciences—including award-winning, AI-powered motion tracking that works equally well for people, moving objects, such as hospital trolleys, and vehicles.

There’s also multi-floor localization, through which an advanced algorithm can localize people across multiple floors without knowledge of a floorplan. And Navenio’s nifty 3D experience mapping uses multiple inputs, including crowdsourced data from people’s movements. Thus, the technology can produce a comprehensive physical map to help prepare a building for localization planning—without ever visiting it.

Crucially, Navenio is infrastructure-free and can be used without any surveying of a building, making it highly scalable. It’s accurate to within a few meters and works where GPS does not, simply by using sensors in smartphones.

The software tracks workers’ movements using their smartphone in real-time, allowing staff to be re-assigned to ensure they are deployed effectively. Porters and cleaners, for example, can be quickly identified and directed to clean a high-risk infection area.

Broad Potential

Navenio is already changing practice. It’s proven effective in hospitals, operating successfully 24/7, in 5,000+ room locations with multiple floors. Beyond healthcare, it promises considerable potential to transform areas as diverse as gaming to indoor parking, and from oil and gas safety to lone working.

United States

Grace Sly, Information Technology and Innovation Foundation

I. Amazon Scout's Automated Delivery Service

As the COVID-19 pandemic disrupted the normal operations of most industries, businesses have been forced to adapt. With physical lockdowns preventing customers from leaving their homes, companies such as Amazon, Uber, and Kiwi have employed autonomous sidewalk delivery robots to facilitate safe, rapid, and contactless delivery.¹⁹⁹ These robots have experienced great success, such as the San Francisco-based company Starship Technologies, which saw an explosion of business following COVID-19 and reported a doubling of deliveries from 500,000 in June 2020 to 1 million by January 2021, as well as a fivefold increase in demand since the beginning of the pandemic.²⁰⁰ Amazon Scout was launched in January 2019 and initially rolled out in Snohomish County, Washington and Irvine, California.²⁰¹ The six-wheeled device moves at a walking pace and, in its inception, has been accompanied by a human supervisor.²⁰² As part of Amazon's path of net zero carbon emissions by 2040, Scout is fully powered by an electric battery.²⁰³

Given the limited capacity of traditional navigation technologies such as GPS, advancements in computer visioning and machine learning have been crucial to guiding Scout's decision-making abilities.²⁰⁴ From maneuvering around people, animals, and objects, to deciding the right time to cross a street, Scout must plan, act, and react intelligently to its surroundings. Sensory data must consider real-world constraints in order to prepare the device for its outdoor environment. Amazon has utilized machine learning with large-scale data sets to build a robot with a more-sophisticated understanding of the world.²⁰⁵

Amid the pandemic, Amazon lauded Scout "[helping them] meet increased customer demand by supplementing [their] transportation network."²⁰⁶ By limiting person-to-person contact, Scout reduced the possibility of dangerous exposure and transmission while enabling the continued delivery of packages and essential goods. Considering the positive impact of autonomous delivery on mitigating risk and meeting increased delivery demand, Amazon announced in July 2020 that a trial of Scout would be offered to select customers in Atlanta, Georgia, and Franklin, Tennessee.²⁰⁷ In July 2021, Amazon announced the creation of a new Amazon Scout Development Center in Helsinki, Finland to focus on research and development of automated delivery services.²⁰⁸ This announcement indicates Amazon's intention to develop Scout's machine learning capabilities and increase the technology's usage.

II. Erica: Bank of America's Virtual Assistant

According to a 2021 KMPG survey, 84 percent of financial service business leaders say that AI is moderately or fully functional at their organization, a 37 percent increase in AI functionality from the previous year.²⁰⁹ Bank of America (BoA) has led the industry in utilizing AI to assist customers through Erica, a virtual chatbot, that is part of the bank's mobile app. By combining AI, predictive analytics, and natural language processing, Erica can complete complex tasks, learn from customer behavior, and provide personalized proactive guidance based on unique situations.²¹⁰ Users can

request assistance through a natural and conversational interaction over voice or text message, as over one million possible financial questions have been integrated into the technology.²¹¹

Erica was launched in the spring of 2018 and has experienced rapid growth, with 10 million users having activated the feature within the app by the end of 2019.²¹² As the COVID-19 pandemic limited in-person banking transactions and heightened the urgency of clients to manage personal finances, Erica added one million users a month from March through May of 2020, with 15 million queries posed in April 2020 alone.²¹³ By the end of 2020, Erica was handling around 400,000 client interactions a day, twice as many as in 2019.²¹⁴ In Q1 2021, Erica's total user base counted more than 19.5 million clients, an increase of 7.3 million from the end of the same quarter of 2020.²¹⁵ Further quarterly comparisons show that the number of interactions jumped from 27.8 million in Q1 2020 to 105.6 million in Q1 2021, with the use Erica in Q1 2021 breaking BoA records by soaring up 198 percent in total interactions from the previous quarter.²¹⁶ The virtual assistant was augmented to understand more than 60,000 phrases related to the pandemic and has been updated regularly with information regarding COVID-19, such as the latest guidance on the federal stimulus.²¹⁷

BoA CEO Brian Moynihan made a 'direct correlation' between the pandemic and how "digital engagement expanded throughout all [of BoA's] businesses through the year."²¹⁸ In addition to Erica's increased userbase growth, the bank's money transfer app, Zelle, saw payments increase by 80 percent from the previous year, sign-ins to the digital platform CashPro increase by 40 percent, and digital wallet use increase 18 percent year-over-year.²¹⁹ This coincided with a drop in cash and check transaction volumes to its lowest level on record, decreasing 21 percent as digital card-based payments gained popularity.²²⁰ Despite the gradual reopening of branches, BoA views digital engagement as crucial to the future and continues to test new virtual services. According to the David Tyrie, head of BoA's digital banking, "We do not expect that if and when the world gets back to a place that's more normalized, [digital adoption] is going to drop."²²¹

III. DataRobot Assists the Government's COVID-19 Preparedness

Federal and local governments have recognized the potential of AI to enhance public service and sought partnerships with forward-thinking companies to introduce new systems, with one Boston-based firm playing a key role in the fight against COVID-19. DataRobot, a leading AI platform, partnered with the federal government during the pandemic to resolve information gaps and improve the visibility of hospital data.²²² Since early 2020, the company has been engaged in pandemic response and continues to advance the future of medical preparedness.

By building AI-based models that can predict viral spread down to the county level, DataRobot has provided resources to inform local policy decisions.²²³ This was achieved by aggregating a variety of sources to find patterns in the demographic and socioeconomic information from counties where COVID-19 cases were reported; researchers then used these patterns to identify similar counties which had not reported cases.²²⁴ The model achieved an 88 percent precision rate with a five-day forecast of its top 50 predictions and a 96 percent precision rate for a 10-day forecast.²²⁵ This resource was part of DataRobot's COVID-19 Long-Term Forecasting and Simulation Decisions Intelligence Platform, whose primary objective was to locate highly impacted areas in order to encourage the equitable distribution of vaccine trials and develop conscientious testing strategies.²²⁶

The company shared the results of its predictions with government response teams and members of Congress in order to more proactively address the outbreak.²²⁷

Both federal and state governments have seen the advantages of AI systems such as DataRobot in addressing future challenges. The National Security Commission on Artificial Intelligence's White Paper Series on Pandemic Response and Preparedness credited DataRobot for building an AI-based prediction model that could exemplify the power of AI to detect early outbreaks and survey diseases in real-time.²²⁸ In a recent hearing, the House Subcommittee on Health heard from Dr. Luciana Borio, M.D., Vice President, In-Q-Tel and Former Acting Chief Scientist of the Food and Drug Administration, that ContagionNet, DataRobot's recently launched not-for-profit initiative, is a promising endeavor for offering increased access to at-home testing and has the potential to improve accuracy as well as ensure timely hotspot identification.²²⁹ (For context, ContagionNet was introduced by DataRobot in February 2021 with the purpose of disrupting the chain of viral transmission by providing a variety of tools, such as at-home antigen checks, that identify the most-contagious areas in a community earlier than traditional testing.)²³⁰ At a state level, West Virginia authorities enthusiastically welcomed DataRobot's new office in Morgantown, with Governor Jim Justice praising the venture as a "complete game changer for the future of the health and wellbeing of our people."²³¹ These are just a few ways the public sector continues to recognize the potential for AI to solve complex issues, address regionally specific issues, and invigorate communities.

San Francisco/Silicon Valley

Sean Randolph, Bay Area Council Economic Institute

While many companies around the world have been harmed by the COVID-19 pandemic, some have prospered, particularly those with business models which address specific needs the pandemic has created. These companies are clustered primarily in digital technologies that enable connectivity when physical presence is difficult. This particularly includes online communication and remote management, IoT, digital health, and digital learning. While many of these companies were operating before COVID-19 hit, the pandemic has accelerated their development. Many of these companies are based in the San Francisco/Silicon Valley Bay Area, the world's epicenter for digital technology and innovation. Most are digital and many are AI-enabled. While nearly all were operating before COVID-19 hit, the pandemic has accelerated their development.

A survey by PWC finds that 52 percent of companies accelerated their AI adoption plans because of the COVID-19 crisis. The great majority—86 percent—say that AI is becoming a mainstream technology. Similarly, a Harris Poll found 55 percent of companies reporting that they had accelerated their AI strategy in 2020 due to COVID-19, with 67 percent expected to further accelerate their AI strategies in 2021.²³² Business leaders from both small (88 percent) and large (80 percent) companies say that AI technology helped them during the COVID crisis. This spells opportunity for both companies using AI as well as the companies producing AI solutions. As the leading center for AI research and commercialization in the United States, companies leading that transition are intensely clustered in the San Francisco/Silicon Valley Bay Area. Several examples follow.

I. Distance Communication

Zoom

Founded in 2011 and headquartered in San Jose, Zoom offers a communications platform that connects people through video, voice chat, and content sharing, using a cloud platform to support video and audio conferencing, collaboration, chat, and webinars across mobile devices, desktops, telephones, and room systems. The company's stated mission is to create a people-centric cloud service that transforms the real-time collaboration experience and improves the quality and effectiveness of communications.

In the early days of the pandemic, Zoom's daily meeting participants grew 30-fold—from 10 million participants to more than 300 million. Annualized Zoom meeting minutes grew from 100 billion in January 2020 to 3 trillion by October. At the same time the company doubled its employee base to 5,000.

Even as more workers are returning to the office, virtual meetings will be embedded in companies' future workforce models. Most are planning to institutionalize some form of hybrid work. Reflecting that, Zoom has recently created virtual receptionists and is working with financial services customers to create virtual tellers and virtual wealth managers that will use AI to recognize nonverbal cues to better engage with customers. AI-enabled meetings and shareable virtual whiteboards will continue

to support the increased participation and the use of collaborative tools that emerged during the pandemic.²³³

II. Telehealth

Truepill

Founded in 2016 and headquartered in San Mateo, Truepill is a business-to-business (B2B) pharmacy fulfillment service that provides application programming interfaces (APIs, software that enables two applications to talk to each other) and fulfillment of medications in 50 states, working with direct-to-consumer brands, digital health companies, and other healthcare organizations.

Umar Afridi, a former pharmacy manager at a 24-hour CVS in East San Jose, and Sid Viswanathan, whose previous startup was bought by LinkedIn, launched the company with a plan to upend the pharmacy business, focusing first on processing orders for direct-to-consumer health brands that were growing quickly. Revenue reached \$48 million in 2018 and nearly \$100 million in 2019 as the company pushed further into working with health plans, drugmakers, and pharmacy benefit managers. Its B2B model utilizes pharmacy as a wedge into the tele-health sector. The company has recently added another service, diagnostics, enabling it to offer white-labeled pharmacy fulfillment, telehealth, and lab testing in one place.

Growth of its virtual service accelerated during the pandemic. With 300 employees, Truepill has delivered more than 5 million prescriptions to patients' doors and supports a network of more than 1,000 specialty clinicians providing virtual care through 10,000+ virtual visits occurring on a 24/7/365 basis. Seventeen investors have provided \$255.4 million in funding to date, including a \$142 million Series D round in October 2021.²³⁴

Doctor On Demand

Founded in 2012 and headquartered in San Francisco, Doctor on Demand is a telemedicine company, offering on-demand and scheduled visits with U.S.-licensed healthcare providers through smartphones, tablets, or computers, focusing on solutions for employers, health plans, retail clinics, and health systems. The company has evolved from a website and app for urgent care visits into a virtual primary and mental healthcare platform that employs more than 700 doctors and supports over 3 million patient visits.

The demand for virtual doctor's appointments grew sharply during the pandemic as lockdowns forced brick-and-mortar doctor's offices to close and patients to stay home. The company's telehealth growth was particularly fueled by visits for behavioral health issues requiring therapy or psychiatry, as well as visits attributable to chronic conditions. In the process, Doctor on Demand became the first large telemedicine provider to cater to the approximately 33 million seniors that are Medicare Part B beneficiaries. In 2020, the company teamed with Humana to launch a new virtual primary care model.²³⁵ Called On Hand, the plan gives patients access to a dedicated primary care physicians as well as preventive care, urgent care, and behavioral health care through video visits with lower monthly premiums.

The company has raised \$235.7 million in funding to date from 29 investors, the most recent being a \$75 million Series D round in July 2020.²³⁶

III. Fintech

Plaid

As businesses and individuals moved massively online during the pandemic, digital finance, which had been growing for more than a decade, accelerated. That included digital and mobile banking, which became the norm for main street banks. With that, most financial transactions have moved to the web and a much broader range of financial services is available from a wider range of providers. Plaid, a fintech startup founded in 2013, provides infrastructure for online banking services by enabling customers to digitally link their financial accounts to apps for personal banking, wealth management, personal finance, business finance, payments and lending, supporting the advancement of a digitally based financial system. Through lending services, for example, borrowers have access to streamlined online loan application services, while lenders get digital access to borrowers' data such as assets, bank balances, routing information for payments, and financial obligations including student loans and credit cards.

Plaid now has six global offices supporting 11,000 financial institutions, including 5,000 fintech startups built on its platform. Investor funding of \$734.3 million includes a D round in August 2021.

Stripe

Cloud-based global e-commerce company Stripe provides a payments platform that aims to optimize the checkout experience for customers, adapted to the customer's language and device. Transactions are scored for risk with machine learning models built on hundreds of millions of data points, helping to reduce fraud. Customers can also build customized point-of-sale experiences that connect online and offline sales, while pre-built integrations connect its platform with hundreds of ecommerce platforms and customers' existing customer management, quotation, inventory, shipping, and accounting tools.

Launched in 2011 and headquartered in San Francisco and Dublin, Stripe has ridden the wave of ecommerce growth that was accelerated by the pandemic, helping both large and small companies accept web and mobile payments. Payments made through Stripe totaled \$350 billion in 2020, a 133 percent increase over 2019 (\$150 billion). Revenues in 2020 grew from \$1.5 billion to \$7.4 billion in 2019, a 393 percent increase.

Stripe currently operates through 14 global offices. Clients include millions of companies in 120 countries including Amazon, Salesforce, Microsoft, Uber, Google, Shopify, Spotify, Lyft Didi, Grab, Postmates, Expedia, Zillow, Peloton, Slack, Booking.com, and Deliveroo among many others. Funding has totaled \$2.8 billion in 18 rounds, the latest in July 2021.²³⁷ In March 2021 the company was valued at \$95 billion.

IV. Connected Devices and AI Infrastructure

Samsara

Founded in 2015 and headquartered in San Francisco, Samsara is a pioneer of the Connected Operations Cloud, which allows businesses that depend on physical operations to harness IoT data to acquire actionable business insights and improve their operations. Samsara operates in North America and Europe serving more than 20,000 customers across a range of industries including transportation, wholesale and retail trade, construction, field services, logistics, utilities and energy, government, healthcare and education, manufacturing, and food and beverages.

The company grew out of the idea that technologies like cloud and AI could transform historically overlooked sectors such as industrial operations and infrastructure. By helping industrial customers capture and analyze data from their physical operations, it helps bring digital transformation to this critical segment of the global economy. Advanced AI capabilities in Samsara's Connected Operations Platform support machine learning that allows customers to take a more proactive and preventative approach to operations and safety.

The COVID-19 pandemic accelerated the use of AI technologies in physical operations-based industries. With operations becoming increasingly connected through digitalization, the increase in remote work, and spikes in demand, many organizations have increased their reliance on real-time data, machine learning and computer vision as a way to operate more efficiently and safely, a trend already underway that the pandemic accelerated.

Remote management of industrial processes is another growth driver. Like Samsara, Instrumental Inc., a Bay Area AI-powered digital startup, has seen disruptions to manufacturing during the COVID pandemic drive larger markets for digital manufacturing data and analysis that can reduce costs and waste. Its cloud-based manufacturing optimization platform, which automates failure analysis and issue discovery, saw a 490 percent increase in demand in the second quarter of 2021 compared to the previous year, enables companies to control production processes at distant or offshore locations without sending engineers to the site.²³⁸

Analyzing a sample cohort of thousands of customers, Samsara saw an 80 percent increase in API pings to its Connected Operations Platform from January 2020 to March 2021, signaling a drive to harness data and boost productivity through automated workflows. In another industry-specific subset of its customer base, from September 2020 to March 2021 Samsara saw a 20 percent increase in the number of transportation and warehousing customers connecting their operations on the cloud by using solutions across three or more distinct areas, an indication of how cloud-based digitalization is expanding into new operational areas.

With 20,000 customers, more than 1 million connected IoT devices, and over 2 trillion data points collected annually, the company has raised \$930 million through seven investment rounds, including a Series F round in May 2020 and a new funding through the secondary market in September 2020.²³⁹

Scale AI

Founded in San Francisco in 2016, Scale AI is a startup that helps companies label and curate data, in order to accelerate the implementation of AI applications. It's among a number of companies that

have sprung up to help businesses deal with the data preparation needed to train AI systems, a process that may require tens of thousands of data points to be annotated with labels.

Scale has grown to become perhaps the largest company in its sector, branching out from its initial focus on image and video data primarily used by companies working on self-driving cars. It currently offers support for a wide variety of both vision and natural language data sources used in businesses ranging from finance to logistics as well as government. Customers include PayPal, Pinterest, Square, Samsung, SAP, Lyft, Toyota, General Motors, LinkedIn, Pinterest, and the U.S. Army and U.S. Air Force.

An enabler of AI applications, Scale has grown from 100 employees a year ago to more than 300 today and is currently valued at \$7.3 billion.²⁴⁰

Conclusion

While the COVID-19 pandemic has presented a range of novel challenges, it has also turbocharged opportunities for innovation. To this end, the development, implementation, and progression of AI has been critical to addressing the unprecedented difficulties confronting governments, businesses, and individuals. This collection of country-specific case studies highlights the various ways nations have embraced AI during the COVID-19 pandemic to address these challenges and demonstrates how both the private and public sectors can responsibly adopt advanced technologies.

The examples provided in this volume illustrate the diverse application of AI solutions and indicate that additional groundbreaking deployments are possible. However, in order to realize the benefit of pioneering new technologies such as AI, nations must commit to implementing policies designed to spur innovation and productivity across all industries. As with COVID-19, future challenges will transcend borders. Therefore, it's time to embrace a new approach to globalization and trade, one fundamentally grounded in advancing innovation for the benefit of humanity.

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